

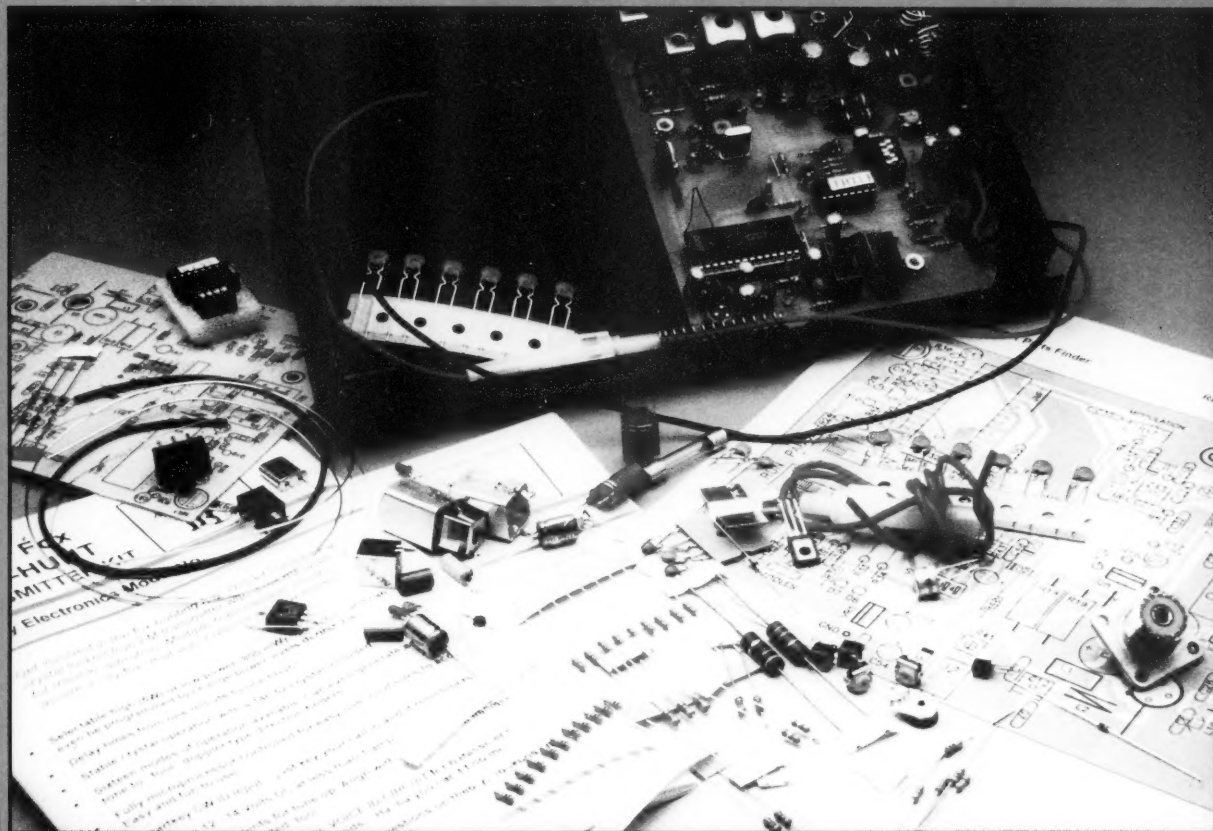
Including Ham Radio Fun!

# 73<sup>®</sup> Amateur Radio Today

MAY 1997  
ISSUE #440  
USA \$3.95  
CANADA \$4.95

International Edition

## Special Construction Issue!



### Bioelectrifier Update

### Hot 40-160m Antenna

### TV Tuner Bonanza-II

### Reviews: Timewave DSP-5000

### WB9KZY Island

### Yaesu FT-1000M

\*\*\*\*\*5-DIGIT 48103  
JUN76 927  
SERIALS PROCESSING DEPT  
UNIV MICROFILMS IT  
300 N ZEEB RD  
ANN ARBOR MI 48103-1553

## Finally – A Professional-Quality Receiver to Monitor Weather Broadcasts!

**NEW** Our new RWX is a very sensitive and selective Hamtronics® grade receiver to monitor critical NOAA weather broadcasts.

Excellent 0.15µV sensitivity provides good reception even at distances of 70 miles or more with suitable antenna. No comparison with ordinary consumer radios!



Automatic mode provides storm watch, alerting you by muting receiver and providing an output to trip remote equipment when an alert tone is broadcast.

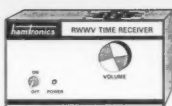
Essential for airports, police and fire departments, CAP, broadcast stations, state and local emergency managers, amateur repeaters – anyone needing a professional quality receiver. Because of its reasonable price, it is also handy for bikers, hikers, boaters, hunters, farmers – or anyone who needs up-to-date weather info and emergency warnings, even from distant stations.

Small enough for emergency or portable use, it can even be powered from a small 9-12V battery when needed. Crystal controlled for accuracy; all 7 channels provided (162.40 to 162.55).

You can buy just the receiver pcb module in kit form or buy the kit with an attractive metal cabinet, AC power adapter, and built-in speaker. It is also available factory wired and tested.

- RWX Rcvr kit, PCB only .....\$79
- RWX Rcvr kit with cabinet, speaker, & AC adapter .....\$99
- RWX Rcvr wired/tested in cabinet with speaker & adapter .....\$139

## WWV RECEIVER



**NEW** Get time and frequency checks without buying multiband hf rcvr. Hear solar activity reports affecting radio propagation. Very sensitive and selective crystal controlled superhet, dedicated to listening to WWV on 10.000 MHz. Performance rivals the most expensive receivers.

Controlled superhet, dedicated to listening to WWV on 10.000 MHz. Performance rivals the most expensive receivers.

- RWWV Rcvr kit, PCB only .....\$59
- RWWV Rcvr kit with cabt, spkr, & 12Vdc adapter .....\$89
- RWWV Rcvr w/it in cabt with spkr & adapter .....\$129

## WEATHER FAX RECEIVER

Join the fun. Get striking images directly from the weather satellites! A very sensitive wideband fm receiver optimized for reception of NOAA APT and Russian Meteor weather fax images on the 137 MHz band.



The R139 is lower cost and easier to maintain than synthesized units. And it is designed from the ground up for optimum satellite reception; not just an off-the-shelf scanner with a shorted-out IF filter!

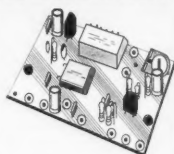
Covers all five satellite channels. Scanner circuit and recorder control allow you to automatically search for and tape signals as satellites pass overhead, even while away from home.

- R139 Receiver Kit less case .....\$159
- R139 Receiver Kit with case and AC power adapter .....\$189
- R139 Receiver w/it in case with AC power adapter .....\$239
- Internal PC Demodulator Board and Imaging Software .....\$289
- Turnstile Antenna .....\$119
- Weather Satellite Handbook .....\$20

## SUBAUDIBLE TONE ENCODER/DECODER

**NEW** Access all your favorite closed repeaters with TD-5 CTCSS Encoder/Decoder

Encodes all standard sub-audible tones with crystal accuracy and convenient DIP switch selection. Comprehensive manual also shows how you can set up a front panel switch to select between tones for several repeaters. Receiver decoder



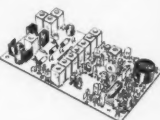
can be used to mute receive audio and is optimized for installation in repeaters to provide closed access. High pass filter gets rid of annoying buzz in receiver.

- TD-5 CTCSS Encoder/Decoder Kit .....only \$39
- TD-5 CTCSS Encoder/Decoder Wired/tested .....\$59

## HIGH QUALITY VHF & UHF FM XMTR AND RCVR MODULES

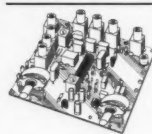
FM EXCITERS: 2W output, continuous duty.

- TA51: for 6M, 2M, 220 MHz .. kit \$99, w/it \$169.
- TA451: for 420-475 MHz, ..... kit \$99, w/it \$169.
- TA901: for 902-928 MHz, (0.5W out) .....w/it \$169.



VHF & UHF POWER AMPLIFIERS.

Output levels from 10W to 100W Starting at \$99.



FM RECEIVERS:

• R100 VHF FM RECEIVERS Very sensitive – 0.15µV. Superb selectivity – both crystal and ceramic IF filters, >100 dB down at ±12kHz, best available anywhere, flutter-proof squelch.

For 46-54, 72-76, 140-175, or 216-225 MHz. ....

- ..... kit \$129, w/it \$189
- R144/R220 RCVRs. Like R100, for 2M or 220 MHz, with helical resonator in front end.....kit \$159, w/it \$219
- R451 FM RCVR, for 420-475 MHz. Similar to R100 above. ....kit \$129, w/it \$189
- R901 FM RCVR, 902-928MHz .....\$159, w/it \$219

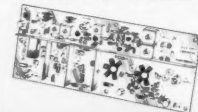
## TRANSMITTING AND RECEIVING CONVERTERS

Go on a ham satellite adventure! Add another band for the next contest. Thrill in the excitement of building your own gear, and save a bundle.



No need to spend thousands on new transceivers for each band!

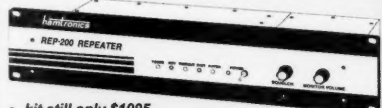
- Convert vhf and uhf signals to/from 10M.
- Even if you don't have a 10M rig, you can pick up very good used xmtrs & rcvrs for next to nothing.
- Receiving converters (shown above) available for various segments of 6M, 2M, 220, and 432 MHz.
- Kits from \$49, wired/tested units only \$99.



- Xmitting converters (at left) for 2M, 432 MHz.
- Kits only \$89 vhf or \$99 uhf.
- Power amplifiers up to 50W output.

## Get more features for your dollar with our REP-200 REPEATER

A microprocessor-controlled repeater with full autopatch and many versatile dtmf control features at less than you might pay for a bare-bones repeater or controller alone!



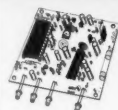
- kit still only \$1095
  - factory assembled still only \$1295
- 50-54, 143-174, 213-233, 420-475 MHz. (902-928 MHz slightly higher.) FCC type accepted for commercial service in 150 & 450 MHz bands.

Digital Voice Recorder Option. Allows message up to 20 sec. to be remotely recorded off the air. Play back at user request by DTMF command, or as a periodic voice id, or both. Great for making club announcements! ..... only \$100.

REP-200C Economy Repeater. Real-voice ID, no dtmf or autopatch. .... Kit only \$795, w/it \$1195.

REP-200N Repeater. Without controller so you can use your own. .... Kit only \$695, w/it \$995.

## You'll KICK Yourself If You Build a Repeater Without Checking Out Our Catalog First!



Hamtronics has the world's most complete line of modules for making repeaters. In addition to exciters, pa's, and receivers, we offer the following controllers.

- COR-3. Inexpensive, flexible COR module with timers, courtesy beep, audio mixer. ....only \$49/kit, \$79 w/it
- CWID. Traditional diode matrix ID'er. ....kit only \$59
- CWID-2. Eeprom-controlled ID'er. ....only \$54/kit, \$79 w/it
- DVR-1. Record your own voice up to 20 sec. For voice id or playing club announcements. ....\$59/kit, \$99 w/it
- COR-4. Complete COR and CWID all on one board. ID in eeprom. Low power CMOS. ....only \$99/kit, \$149 w/it
- COR-6. COR with real-voice ID. Low power CMOS, non-volatile memory. ....kit only \$99, w/it only \$149
- COR-5. µP controller with autopatch, reverse ap, phone remote control, lots of DTMF control functions, all on one board, as used in REP-200 Repeater. ....\$379 w/it
- AP-3. Repeater autopatch, reverse autopatch, phone line remote control. Use with TD-2. ....kit \$89
- TD-2. Four-digit DTMF decoder/controller. Five latching on-off functions, toll call restrictor. ....kit \$79
- TD-4. DTMF controller as above except one on-off function and no toll call restrictor. Can also use for selective calling; mute speaker until someone pages you. ....kit \$49

## LOW NOISE RECEIVER PREAMPS

LNG-( ) G<sub>A</sub> FET PREAMPS STILL ONLY \$59!

- Make your friends sick with envy! Work stations they don't even know are there.
- Install one at the antenna and overcome coax losses.
- Available for 28-30, 46-56, 137-152, 152-172, 210-230, 400-470, and 800-960 MHz bands.



LNW-( ) ECONOMY PREAMPS ONLY \$29 kit, \$44 wired/tested

- Miniature MOSFET Preamp
- Solder terminals allow easy connection inside radios.
- Available for 25-35, 35-55, 55-90, 90-120, 120-150, 150-200, 200-270, and 400-500 MHz bands.



- Buy at low, factory-direct net prices and save!
- For complete info, call or write for free catalog.
- Order by mail, fax, or phone (9-12 AM, 1-5 PM eastern time).
- Min. \$5 S&H charge for first pound plus add'l weight & insurance.
- Use VISA, Mastercard, Discover, check, or UPS C.O.D.

View Catalog on our Web site:  
www.hamtronics.com  
e-mail: jv@hamtronics.com

Our 25th Year!  
**hamtronics, inc.**  
65-D Moul Rd; Hilton NY 14468-9535  
Phone 716-392-9430 (fax 9420)



# Have Beam, Will Travel!

*Shake, twist—your walking stick becomes a beam!*

How would you like a four element 2 meter yagi that travels the mountain trails as a walking stick? Pick a rest stop, remove the end cap, shake out the elements and feedline, and in two minutes your HT is full quieting wherever you point it.

Finished resting? Unscrew the elements and drop them into the boom; you're ready for travel. But whenever you get the urge, it's there, ready to zero in on a jammer, chase a radio fox, or shoot your signal out of a hole in time of difficulty.

**What is it?** ArrowBeam. It shoots straight and true, and its strong flexible elements are stored in the boom like arrows in a quiver. It weighs only a pound and a half and is balanced in the hand, but it can take abuse.

Keep it in the trunk of the car. It's tough exterior protects everything against damage as it gets tossed and knocked about. But when it's time for action—shake, twist,

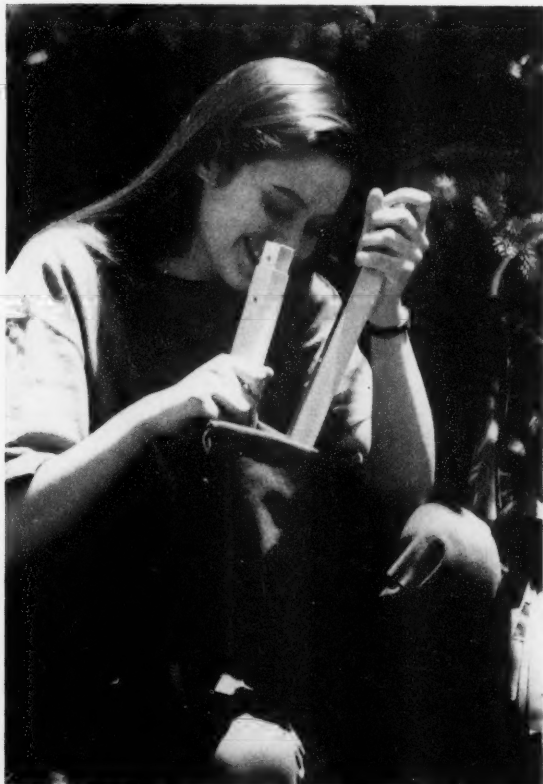
and ArrowBeam is ready to shoot your RF right where you want it.

This handy versatile antenna is made to be dropped, bumped, and stepped on while you are racing through brush and branches in pursuit of the elusive radio fox. Drop it? It bounces. Snag a low limb as you drive by? Twang! the tempered elements just spring back into position. Sit on it? You'll need a bandaid for your fancy, but ArrowBeam will be ready for more.

Of course ArrowBeam will do just fine in an attic or on a mast even though it's made for the torture of the T-hunt.

**Performance?** ArrowBeam scored best for its boom length at the Dayton VHF competition. It's the antenna chosen by the FAA for its spook beacon and rogue ELT search teams.

Now you can have ArrowBeam's performance and toughness for your radio adventures.



## Half-Size ArrowBeam?

Now there's a version of ArrowBeam that breaks down to half the Walking Stick size—the Grab-N-Go ArrowBeam. For storage the boom separates at the center, so the whole antenna stores in half the length—perfect for slipping in a backpack.

You get the same great performance, the same ease of assembly, the same robust durability, but Grab-N-Go fits in your suitcase.

The Grab-N-Go ArrowBeam comes in its own forest green stuff sack. There's extra room there for other goodies you may wish to carry with your beam—feedline, homebrew PVC mast, omnidirectional Pico-J antenna, etc. This is the version Becca is taking on her trip.

## ArrowBeams

- **Walking Stick 2m** \$79  
Elements 4 Boom Length 48"  
Gain 6.1 dB Front/Back 10.1 dB  
SWR <1.1 min, <1.5 band edges  
Add \$6 S&H
- **Grab-N-Go 2m** \$89  
Same as above, but breaks down to <25" for storage. Mast mount and Forest Green Stuff Sack included.  
Add \$6 S&H
- **Walking Stick 70cm** \$49  
Elements 5 Boom Length 40"  
Gain 7.3 dB Front/Back 12.1 dB  
SWR <1.1 min, <1.5 band edges  
Add \$5 S&H

## Other Range Extenders

- Pico-J 2m \$19.95 ppd
- Pico-J 2m/70cm \$26 ppd
- 2m Packet Pico-J \$22 ppd
- TigerTail (2m/70cm) \$8 ppd

## Save \$5

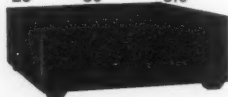
Order more than one item and knock \$5 and shipping off the price of each after the first.

☐ Yes. Send ArrowBeam: ☐ WS2m ☐ WS70cm ☐ GnG 2m  
☐ Yes. Send my ☐ Pico-J Model: ☐ TigerTail  
 Name \_\_\_\_\_  
 Call \_\_\_\_\_ Phone \_\_\_\_\_  
 Street \_\_\_\_\_ Apt \_\_\_\_\_  
 City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_  
**Antennas West** InfoPak Order Hotline  
 Box 50062-S Provo UT 84605 \$1 800 926 7373

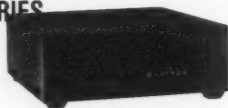
CIRCLE 57 ON READER SERVICE CARD

## NEW SWITCHING POWER SUPPLIES

	CONT.	ICS	WT.(LBS)
SS-10	7	10	3.2
SS-12	10	12	3.4
SS-18	15	18	3.6
SS-25	20	25	4.2
SS-30	25	30	5.0



## SL SERIES



## ASTRON POWER SUPPLIES

• HEAVY DUTY • HIGH QUALITY • RUGGED • RELIABLE •

### SPECIAL FEATURES

- SOLID STATE ELECTRONICALLY REGULATED
- FOLD-BACK CURRENT LIMITING Protects Power Supply from excessive current & continuous shorted output
- CROWBAR OVER VOLTAGE PROTECTION on all Models except RS-3A, RS-4A, RS-5A, RS-4L, RS-5L
- MAINTAIN REGULATION & LOW RIPPLE at low line input Voltage
- HEAVY DUTY HEAT SINK • CHASSIS MOUNT FUSE
- THREE CONDUCTOR POWER CORD except for RS-3A
- ONE YEAR WARRANTY • MADE IN U.S.A.

### PERFORMANCE SPECIFICATIONS

- INPUT VOLTAGE: 105-125 VAC
- OUTPUT VOLTAGE: 13.8 VDC  $\pm$  0.05 volts (Internally Adjustable: 11-15 VDC)
- RIPPLE Less than 5mv peak to peak (full load & low line)
- All units available in 220 VAC input voltage (except for SL-11A)

### LOW PROFILE POWER SUPPLY

MODEL	Colors Gray Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt. (lbs.)
SL-11A	• •	7	11	2 1/2 x 7 x 9 1/4	12
SL-11R	• •	7	11	2 1/2 x 7 x 9 1/4	12
SL-11S	• •	7	11	2 1/2 x 7 x 9 1/4	12
SL-11R-RA	• •	7	11	4 1/4 x 7 x 9 1/4	13

## RS-L SERIES



### POWER SUPPLIES WITH BUILT IN CIGARETTE LIGHTER RECEPTACLE

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt. (lbs.)
RS-4L	3	4	3 1/2 x 6 1/2 x 7 1/4	6
RS-5L	4	5	3 1/2 x 6 1/2 x 7 1/4	7

## RM SERIES



MODEL RM-35M

### 19" RACK MOUNT POWER SUPPLIES

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt. (lbs.)
RM-12A	9	12	5 1/4 x 19 x 8 1/4	16
RM-35A	25	35	5 1/4 x 19 x 12 1/2	38
RM-50A	37	50	5 1/4 x 19 x 12 1/2	50
RM-60A	50	55	7 x 19 x 12 1/2	60

### Separate Volt and Amp Meters

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt. (lbs.)
RM-12M	9	12	5 1/4 x 19 x 8 1/4	16
RM-35M	25	35	5 1/4 x 19 x 12 1/2	38
RM-50M	37	50	5 1/4 x 19 x 12 1/2	50
RM-60M	50	55	7 x 19 x 12 1/2	60

## RS-A SERIES



MODEL RS-7A

MODEL	Colors Gray Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt. (lbs.)
RS-3A	• •	2.5	3	3 x 4 x 5 1/4	4
RS-4A	• •	3	4	3 x 4 x 5 1/4	5
RS-5A	• •	4	5	3 1/2 x 6 1/2 x 7 1/4	7
RS-7A	• •	5	7	3 1/2 x 6 1/2 x 9	9
RS-10A	• •	7.5	10	4 x 7 1/2 x 10 1/2	11
RS-12A	• •	9	12	4 1/2 x 8 x 9	13
RS-12B	• •	9	12	4 x 7 1/2 x 10 1/2	13
RS-20A	• •	16	20	5 x 9 x 10 1/2	18
RS-35A	• •	25	35	5 x 11 x 11	27
RS-50A	• •	37	50	6 x 13 1/4 x 11	46
RS-70A	• •	57	70	6 x 13 1/4 x 12 1/2	48

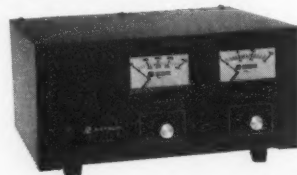
## RS-M SERIES



MODEL RS-35M

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt. (lbs.)
RS-12M	9	12	4 1/2 x 8 x 9	13
RS-20M	16	20	5 x 9 x 10 1/2	18
RS-35M	25	35	5 x 11 x 11	27
RS-50M	37	50	6 x 13 1/4 x 11	46
RS-70M	57	70	6 x 13 1/4 x 12 1/2	48

## VS-M AND VRM-M SERIES



MODEL VS-35M

### Separate Volt and Amp Meters • Output Voltage adjustable from 2-15 volts • Current limit adjustable from 1.5 amps to Full Load

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt. (lbs.)
	@13.8VDC @10VDC @5VDC	@13.8V		
VS-12M	9 5 2	12	4 1/2 x 8 x 9	13
VS-20M	16 9 4	20	5 x 9 x 10 1/2	20
VS-35M	25 15 7	35	5 x 11 x 11	29
VS-50M	37 22 10	50	6 x 13 1/4 x 11	46
VS-70M	57 34 16	70	6 x 13 1/4 x 12 1/2	48

### Variable rack mount power supplies

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt. (lbs.)
VRM-35M	25	35	5 1/4 x 19 x 12 1/2	38
VRM-50M	37	50	5 1/4 x 19 x 12 1/2	50

## RS-S SERIES



MODEL RS-12S

### Built in speaker

MODEL	Colors Gray Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt. (lbs.)
RS-7S	• •	5	7	4 x 7 1/2 x 10 1/4	10
RS-10S	• •	7.5	10	4 x 7 1/2 x 10 1/4	12
RS-12S	• •	9	12	4 1/2 x 8 x 9	13
RS-20S	• •	16	20	5 x 9 x 10 1/2	18
SL-11S	• •	7	11	2 1/2 x 7 x 9 1/4	12

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# 73<sup>®</sup> Amateur Radio Today

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ISSUE #440

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| K2OAW | 64 | Communications Simplified, Part 17  |
| AD1B  | 68 | 2m Self-Supporting Delta Loop<br><i>So simple—and perfect for apartment dwellers.</i> |

**On the cover:** Ramsey Electronics' Sly Fox Fox-Hunt Transmitter Kit signals this month's construction theme. Photo courtesy of Ramsey. **The rest of you** can now get busy earning your 15 minutes of fame (and slightly less fortune) by shooting and sending in your color shots of the antenna farm, the shack, Field Day, or ??? Remember to format your goodies for cover use (and leave some mainly solid-color background for blurbs), but otherwise, the sky's the limit!

**Feedback:** Any circuit works better with feedback, so please take the time to report on how much you like, hate, or don't care one way or the other about the articles and columns in this issue. G = great!, O = okay, and U = ugh. The G's and O's will be continued. Enough U's and it's Silent Keysville. Hey, this is *your* communications medium, so don't just sit there scratching your....er...head. FYI: Feedback "number" is usually the page number on which the article or column starts.

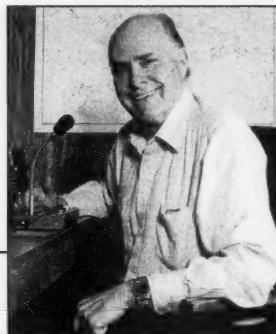
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# NEVER SAY DIE

Wayne Green W2NSD/1



## 220 PITY?

I am pleased to report that every club newsletter I've seen that mentioned the potential loss of 144 and 450 MHz to the Low Earth Orbit (LEO) companies has 100% supported the ARRL position. I like to see solidarity like that, no matter how wrong-headed. Obviously none of the newsletter editors has read my editorial views on this subject, nor have any of their club members tuned them in. Figures.

For any newcomers, and for readers with particularly short memories, I reported that when the LEOs decided to go for our 144 and 450 bands for their satellite use, the ARRL met with them and, instead of trying to reason or come to some compromise, the League representatives threatened to have their members make life miserable for the LEOs if they didn't stop trying to take our bands.

The LEO reaction was predictable. It was the same as I would have reacted. The LEO group got mad and any chance of their backing down was blown. So I was sort of amused to read that the LEOs have added our 220 MHz band to their list. Maybe, if our paper dragon blusters some more, they'll add our 1296 MHz band to their list. Hey, it's worth a try.

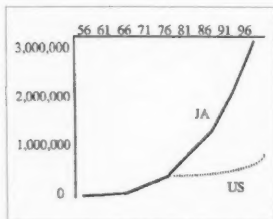


Fig. 1. Comparison of growth of amateur licenses in Japan and the U.S.

Let's look at the game board. It's a map of Washington and the goal is influencing Congress. On one side we see an army of well-heeled lobbyists surrounding the appropriate committee members, waving wads of "reelection" cash at them—on the other, an old ARRL lobbyist ham sitting there with no budget, wondering what in hell he can do.

Of course, if we had three million hams, as they do in Japan (with half our population), that would be another story.

How serious are the LEO guys? Their plan is to provide a service which will virtually eliminate the need for wires or coax into businesses and the home. Over three quarters of all the satellites planned to be orbited in the next few years are for this service. We're talking pocket telephones which will let us talk to anyone on earth. We're talking high-speed digital data and video. And all this means bandwidth (spectrum), which has to come from somewhere, and guess which "service" has the least political clout to protect its spectrum?

Who needs emergency ham communications when there are hundreds of low earth orbit satellites to relay voice, data and video to anywhere on earth? Tornadoes, earthquakes and other disasters aren't going to affect this system. So what other ham services does that leave, for us to cite as a reason for our being allocated badly-needed spectrum? We're up in the trillion dollar range.

Sure, in WWII days the ham population helped save the country's bacon by providing 40,000 radio and electronics technicians and radio operators. And before the ARRL gutted our growth with their monumentally stupid push to expand membership 30 years ago we hams were

busy experimenting and pioneering new modes of communications. We were providing a very valuable service in exchange for our ham bands. Worse, if our growth hadn't been suddenly stopped, we would have around five or six million hams today, and most of 'em would be youngsters bent on high-tech careers, just as it was before the 1965 catastrophe.

It's going to take millions of technicians, engineers, and scientists to design, build, sell, install, operate, and service the coming world communications network. And most of these chaps are *not* going to be Americans. Not with our school system.

So can you see why the LEO group, with billions of dollars at stake, is snickering over the ARRL power play? Or why I call the League a paper dragon?

Instead of urging the hundreds of ARRL member clubs to write nasty letters to the LEO group, we might stand a better chance of survival if the clubs (a) started electing members to their state House and Senate so we'd start having some political clout, and (b) push their local school boards to institute an eight-year course in the fundamentals of electricity, computers, and communications for any student interested in being able to cope with the needs of the 21st century work force. Instead they're trying to fight an unwinnable battle which could hasten our destruction.

But I'll bet I won't see any hint of this scenario in any ham club newsletters.

On the bright side, I don't see any commercial needs for our HF bands, so I'm waiting anxiously for the sun spots to return and propagation to pick up. Amateur radio has provided me with a lifetime of enjoyment, learning

and adventure. If we blow this one, I'm going to miss it.

Who are these LEO companies that the League has threatened? Well, there's Teledesic, which is planning to loft 840 satellites. That's Bill Gates and Craig McCaw. There's Iridium with 66 satellites and backed by Motorola, Raytheon, Lockheed Martin, Sprint, and 13 others. Globalstar plans 48 satellites, backed by Loral Space and Communications and Qualcomm Inc. Orbcomm plans 28 satellites, backed by Orbital Sciences and Teleglobe. That adds up to around 1,000 more satellites.

The biggest, Teledesic, will be an "Internet in the sky" and aims to replace the need for fiberoptic cable systems. These new services will allow hand-held phones, pagers, remote phones, the keeping track of trucks and planes, the remote monitoring of anything, FAX, etc. And that's what the 21st century is going to be like. We'll get used to it.

## East vs. West

Take a look at the graph. It compares the growth of amateur licenses in Japan and the U.S. in recent years. The American no-code ticket resulted in an uptick of U.S. licenses. But look at what's been going on in Japan. While we have around 700,000 licensed hams on the books, Japan has now over three million! And that's with *half* our population.

One sees the difference just by looking at the Japanese ham magazine. It's well over 400 pages a month and packed with interesting-looking construction projects and technical articles. A couple of generations ago we had a section of Manhattan with a half dozen or so ham stores all in the Cortlandt Street area. Boy, did I haunt those stores. In Tokyo I just couldn't get over the Akihabara section of town where there are hundreds of stores selling electronic parts, all swarming with Japanese youngsters buying 'em by the bags full. We don't have anything like Cortlandt Street anywhere in our country anymore—with Cy W2BNW selling surplus gear, Blat The Radio Man, Harrison Radio, and so on. Sigh.

With ham clubs in every school in Japan it's no wonder they have so many hams. And, as used to happen here, a high

*Continued on page 7*

## Synthesized FM Stereo Transmitter

Microprocessor controlled for easy freq programming using DIP switches, no drift, your signal is rock solid all the time - just like the commercial stations. Audio quality is excellent, connect to the line output of any CD player, tape deck or mike mixer and you're on-the-air. Foreign buyers will appreciate the high power output capability of the FM-25; many Caribbean folks use a single FM-25 to cover the whole island! New, improved, clean and hum-free runs on either 12 VDC or 120 VAC. Kit comes complete with case set, whip antenna, 120 VAC power adapter - easy one evening assembly.

FM-25, Synthesized FM Stereo Transmitter Kit ..... \$129.95



## Tunable FM Stereo Transmitter

A lower cost alternative to our high performance transmitters. Offers great value, tunable over the 88-108 MHz FM broadcast band, plenty of power and our manual goes into great detail outlining aspects of antennas, transmitting range and the FCC rules and regulations. Connects to any cassette deck, CD player or mixer and you're on-the-air, you'll be amazed at the exceptional audio quality! Runs on internal 9V battery or external power from 5 to 15 VDC, or optional 120 VAC adapter. Add our matching case and whip antenna set for a nice finished look.

FM-10A, Tunable FM Stereo Transmitter Kit ..... \$34.95

CFM, Matching Case and Antenna Set ..... \$14.95

## RF Power Booster Amplifier



Add some serious muscle to your signal, boost power up to 1 watt over a frequency range of 100 KHz to over 1000 MHz! Use as a lab amp for signal generators, plus many foreign users employ the LPA-1 to boost the power of their FM Stereo transmitters, providing radio service through an entire town. Power required: 12 to 15 volts DC at 250mA, gain of 38dB at 10 MHz, 10 dB at 1000 MHz. For a neat, professionally finished look, add the optional matching case set.

LPA-1, Power Booster Amplifier Kit ..... \$39.95

CLPA, Matching Case Set for LPA-1 Kit ..... \$14.95

LPA-1WT, Fully Wired LPA-1 with Case ..... \$99.95

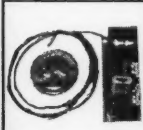


## Micro FM Wireless Mike

World's smallest FM transmitter. Size of a sugar cube! Uses SMT (Surface Mount Technology) devices and mini electret condenser microphone, even the battery is included. We give you two complete sets of SMT parts to allow for any errors or mishaps-build it carefully and you've got extra SMT parts to build another! Audio quality and pick-up is unbelievable, transmission range up to 300 feet, tunable to anywhere in standard FM band 88 to 108 MHz. 7/8" w x 3/8" h x 3/4" d.

FM-5 Micro FM Wireless Mike Kit ..... \$19.95

## Crystal Controlled Wireless Mike



Super stable, drift free, not affected by temperature, metal or your body! Frequency is set by a crystal in the 2 meter Ham band of 146.535 MHz, easily picked up on any scanner radio or 2 meter rig. Changing the crystal to put frequency anywhere in the 140 to 160 MHz range-crystals cost only five or six dollars. Sensitive electret condenser mike picks up whispers anywhere in a room and transmit up to 1/4 mile. Powered by 3 volt Lithium or pair of watch batteries which are included. Uses the latest in SMT surface mount parts and we even include a few extras in case you sneeze and lose a part!

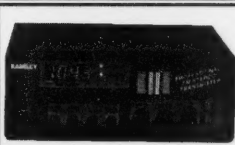
FM-6, Crystal Controlled FM Wireless Mike Kit ..... \$39.95

FM-6WT Fully Wired FM-6 ..... \$99.95

**Call for our Free Catalog !**

# RAMSEY

## Super Pro FM Stereo Radio Transmitter



A truly professional frequency synthesized FM Stereo transmitter station in one easy to use, handsome cabinet. Most radio stations require a whole equipment rack to hold all the features

we've packed into the FM-100. Set frequency easily with the Up/Down freq buttons and the big LED digital display. Plus there's input low pass filtering that gives great sound no matter what the source (no more squeals or swishing sounds from cheap CD player inputs!) Peak limiters for maximum 'punch' in your audio - without over modulation. LED bargraph meters for easy setting of audio levels and a built-in mixer with mike and line level inputs. Churches, drive-ins, schools and colleges find the FM-100 to be the answer to their transmitting needs, you will too. No one offers all these features at this price! Kit includes sharp looking metal cabinet, whip antenna and 120 volt AC adapter. Also runs on 12 volts DC.

We also offer a high power export version of the FM-100 that's fully assembled with one watt of RF power, for miles of program coverage. The export version can only be shipped outside the USA, or within the US if accompanied by a signed statement that the unit will be exported.

FM-100, Professional FM Stereo Transmitter Kit ..... \$299.95

FM-100WT, Fully Wired High Power FM-100 ..... \$429.95

## Speech Descrambler Scrambler



Decode all that gibberish! This is the popular descrambler / scrambler that you've read about in all the Scanner and Electronic magazines. The technology used is known as speech inversion which is compatible with most cordless phones and many police department systems, hook it up to scanner speaker terminals and you're in business. Easily configured for any use: mike, line level and speaker output/inputs are provided. Also communicate in total privacy over telephone or radio, full duplex operation - scramble and unscramble at the same time. Easy to build, all complex circuitry contained in new custom ASIC chip for clear, clean audio. Runs on 9 to 15VDC, RCA phono type jacks. Our matching case set adds a super nice professional look to your kit.

SS-70A, Speech Descrambler/Scrambler Kit ..... \$39.95

CSS, Custom Matching Case and Knob Set ..... \$14.95

SS-70AWT, Fully Wired SS-70A with Case ..... \$79.95

AC12-5, 12 Volt DC Wall Plug Adapter ..... \$9.95

## Tone-Grabber Touch Tone Decoder / Reader



Dialled phone numbers, repeater codes, control codes, anywhere touch-tones are used, your TG-1 will decode and store any number it hears. A simple hook-up to any radio speaker or phone line is all that is required, and since the TG-1 uses a central office quality decoder and microprocessor, it will decode digits at virtually any speed! A 256 digit non-volatile memory stores numbers for 100 years - even with the power turned off, and an 8 digit LED display allows you to scroll through anywhere in memory. To make it easy to pick out numbers and codes, a dash is inserted between any group or set of numbers that were decoded more than 2 seconds apart. The TG-1 runs from any 7 to 15 volt DC power source and is both voltage regulated and crystal controlled for the ultimate in stability. For stand-alone use add our matching case set for a clean, professionally finished project. We have a TG-1 connected up here at the Ramsey factory on the FM radio. It's fun to see the phone numbers that are dialed on the morning radio show! Although the TG-1 requires less than an evening to assemble (and is fun to build, too!), we offer the TG-1 fully wired and tested in matching case for a special price.

TG-1, Tone Grabber Kit ..... \$39.95

CTG, Matching Case Set for TG-1 Kit ..... \$14.95

TG-1WT, Fully Wired Tone Grabber with Case ..... \$149.95

AC12-5, 12 Volt DC Wall Plug Adapter ..... \$9.95



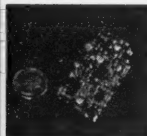
## Mini-Peeper Micro Video Camera

Super small, high quality fully assembled 8 & W CCD TV camera the size of an ice cube! Provides excellent pictures in low light (2 lux), or use our IR-1 Infra-Red light source to invisibly illuminate an entire room on a pitch black night! Imagine the possibilities... build it into a smoke detector, wall clock, lamp, book, radio. Exact same camera that's in big buck detective catalogues and stores. Kit includes: fully assembled CCD camera module, connectors, interface PC board kit with proper voltage regulation and filtering, hook-up details, even a mini microphone for sensitive sound! Two models available: Wide Angle Lens 3.6mm/12, adjustable focus lens, 92 degree view, Pinhole Lens 5.5mm/14.5, 60 degree view. The Pinhole Lens is physically much flatter and provides even greater depth of focus. The camera itself is 1.2" square. The Wide Angle Lens is about 1" long, Pinhole Lens about 1/2", interface PC board is 1" x 2" and uses RCA jacks for easy hook-up to VCRs, TVs or cable runs. Power required is 9 to 14 VDC @ 150 mA. Resolution: 380 x 350 lines. Instruction manual contains ideas on mounting and disguising the Mini-Peeper along with info on adding one of our TV Transmitter kits (such as the MTV-7 unit below) for wireless transmission!

MP-1, Wide Angle Lens CCD TV Camera Outfit ..... \$169.95

MP-1PH, Pin-Hole Lens CCD TV Camera Outfit ..... \$189.95

## MicroStation Synthesized UHF TV Transmitter



Now you can be in the same league as James Bond. This transmitter is so small that it can fit into a pack of cigarettes - even including a CCD TV camera and battery! Model airplane enthusiasts put the MTV-7A into airplanes for a dynamite view from the cockpit, and the MTV-7A is the transmitter of choice for balloon launches. Transmitter features synthesized, crystal controlled operation for drift-free transmission of both audio and video on your choice of frequencies: Standard UHF TV Channel 52 (which should only be used outside of the USA to avoid violating FCC rules), and 439.25 MHz or 911.25 MHz which are in the amateur ham bands. The 439.25 MHz unit has the nifty advantage of being able to be received on a regular 'cable-ready' TV set tuned to Cable channel 68, or use our ATV-74 converter and receive it on regular TV channel 3. The 911.25 MHz unit is suited for applications where reception on a regular TV is not desired, an ATV-79 must be used for operation. The MTV-7A's output power is almost 100 mW, so transmitting range is pretty much 'line-of-sight' which can mean many miles! The MTV-7A accepts standard black and white or color video and has its own, on-board, sensitive electret microphone. The MTV-7A is available in kit form or fully wired and tested. Since the latest in SMT (Surface Mount Technology) is used to provide for the smallest possible size, the kit version is recommended for experienced builders only. Runs on 12 VDC @ 150 mA and includes a regulated power source for a CCD camera.

MTV-7A, UHF TV Channel 52 Transmitter Kit ..... \$159.95

MTV-7AWT, Fully Wired Channel 52 Transmitter ..... \$249.95

MTV-7A4, 439.25 MHz TV Transmitter Kit ..... \$159.95

MTV-7A4WT, Fully Wired 439.25 MHz Transmitter ..... \$249.95

MTV-7A9, 911.25 MHz TV Transmitter Kit ..... \$179.95

MTV-7A9WT, Fully Wired 911.25 MHz Transmitter ..... \$269.95

ATV-74, 439.25 MHz Converter Kit ..... \$159.95

ATV-74WT, Fully Wired 439.25 MHz Converter ..... \$249.95

ATV-79, 911.25 MHz Converter Kit ..... \$179.95

ATV-79WT, Fully Wired 911.25 MHz Converter ..... \$269.95

## RAMSEY ELECTRONICS, INC.

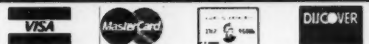
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# LETTERS

## From the Ham Shack

**Ken Dumminger N8VWZ, Fremont OH.** (See April's "Never Say Die.") Recently, Kenwood announced that they were changing their dealer structure to sell through more outlets. The amateur radio community was in an uproar regarding this policy. I read messages on packet that indicated that Kenwood would be selling radios at truck stops, etc. The economics is quite simple. If you are a manufacturer and your products aren't selling then you have to find new arenas in which to sell before you go out of business. When you connect to these manufacturers' Web pages you find that many of them have diversified and are selling to other markets (e.g., marine, etc.).

What I am trying to say is that in the foreseeable future we in the ham community are going to be told that our spectrum is worth a lot of money to the general public so the FCC and Congress are going to sell it to the highest bidder. Based on recent sales of spectrum by the FCC, the commercial radio community is willing to pay large sums of money to get this spectrum. An example of this is what has happened to the broadcast industry. They negotiated with Congress to lock in their spectrum for the purpose of the new digital HD TV broadcast. Recently it was announced that NBC was purchasing new transmitters for their future and the other networks are doing the same.

This leaves two other organizations that have a large amount of spectrum: the military and the amateur community. I am sure that the military isn't going to give up any spectrum, or if they do it will be minimal. This leaves only the amateur spectrum. In the past we haven't paid a cent for our spectrum, but Congress and the FCC have a wealth of buyers at their doorstep with new technologies. Where do you think they are going to look for new spectrum? It doesn't take much to figure this one out.

We as a lobby group are losing our position. The drop in

membership of this fraternity is becoming alarming. We are not licensing new hams in other than Technician Class. We are hung up on the "code issue" to the point that we are willing to lose everything rather than adjust to the new markets. I am 50 years old. I have been working with my local club to get membership. Bottom line is why do I want to become a ham and pay big bucks for equipment when I can communicate either with cell phones, the Internet, or inexpensive GRS radios from Radio Shack. Young people see no need for the hobby. Older people are driving up and down the highway using cell phones and can get on the Internet for the price of a meal and can connect to anyone or anything. Even the public service people are getting so sophisticated that their need for the ham community for emergencies and public safety is becoming minimal. I recently heard a Red Cross official state that in their emergency plan they have decided to use cell phones rather than hams. While we can debate this issue for quite a long time, the simple fact is the public is going around us.

We are spending so much energy regarding classes of license and the importance of code that we have convinced the public that it is so difficult to participate in amateur radio that most don't want to get involved. Elmering is almost a lost art. Most of the interested people cannot even find an Elmer. They just go buy a book and take the test. Code, for the most part, is only used to keep people out of the hobby rather than bring them in. Older hams are reluctant to give on this issue because they have the bands and enjoy operating with less interference. The use of Morse Code for all practical purposes is gone. Most ships don't even have radio rooms. The military dropped the code years ago. I could go on and on, but the bottom line is the fact that very little licensing is being done on the level that we need to justify the spectrum. "If you snooze you lose," seems to be the position at the FCC.

The FCC is even looking at their staff. You are seeing announcements of people who are leaving the FCC to take jobs in the private sector. We are seeing the requirement for paperwork dropping. No renewal notices, instant licensing, etc. Even the testing has gone VE. What is going on? Simply, the FCC is an organization that is going to collect fees and sell spectrum. The new people at the FCC are interested in the bottom line. The technical aspect is going or already gone.

In closing, I would like to say that I enjoy amateur radio. I enjoy the activities and the technology. However, am I going to spend months learning code so that I can get permission to use the low bands? Why should I? Amateur radio is a hobby and I don't have the time to spend. I have a business and a family, plus I am involved in my community. Most of this is more important than getting a higher class license. I have no problem taking a test as to what I know... I have typing skills and a computer which is very fast. Why can't I use that and take a typing test rather than learn to reinvent the wheel? Why aren't the astronauts required to learn code to be able to fly our space ships?

*Troublemaker... Wayne.*

**Mike Miller WA8YKN, Richmond IN.** I read the interesting report from George Bergstrom of Rancho Cordova, California, in the Letters column of the March issue, which included George's circuit for his "blood purifier." While this perhaps overly-complex circuit will probably work fine and give the same results as the other methods used to produce the same output, I feel I should point out that it violates the first rule of bioelectric experimentation. It is important that *any* device which is attached to the body via low-resistance electrodes be *battery powered!* There should be no potential anywhere in the circuit higher than that which is needed to achieve the required current flow. The Bergstrom circuit is operated from the 120-volt AC power line. There is always the possibility that someone may

improperly wire the circuit, which could lead to a tragedy. Even if everything is properly connected, you should keep in mind that your *life* depends on the integrity of the transformer wire insulation every time you connect it to your body! Electrocuting experimental subjects can generate bad press. There are politicians who are waiting to do the bidding of the drug lobbyists, so let's not give them a reason we can easily avoid.

*Mike's right. Batteries are cheap and lawsuits aren't. How many of you would bet your life on how well your AC line is grounded?... Wayne.*

**Scott Rorex KI5FC, Imboden AR.** In your March editorial you asked that we let you know if we are interested in doing anything about the young ham situation. I am interested. This is what has happened here so far. Our children are seven and nine years old. I agree with your thinking about education and have tried for a couple of years to get ham radio and other technology incorporated into the existing school here.

Generally I have found the administration and some teachers interested, but the bureaucracy pretty much has tied their hands. Next, I got some extra copies of *Declare War, Dumbing Us Down*, *Smart Schools - Smart Kids*, and *If You Want To Be Rich and Happy, Don't Go To School*. I've handed these out to the superintendent and some teachers, principals, board members and other parents.

Your mentioning the Sudbury Valley School is just what I was looking for. When I read that I went to see if they had a Web page. They have a great one, with a list of about 20 similar schools around the world and links to several of the other schools ([www.sudval.org](http://www.sudval.org)). Please check it out. I believe that simply by making parents and students aware of the Web pages and then seeing what is on those Web pages, the bureaucracy won't be able to stop them. I see amateur radio as a perfect fit in a school like Sudbury Valley.


Thanks for helping wake us up. *Good show, but Scott, we need irritants like you in every town... Wayne.*



**Lester Warriner WA7HAM, Prosser WA.** Please check out the ad on page 148 (March QST) for the ARRL Amateur Radio License Weekend Technician Class. \$159 for 20 hours of class, two books and a binder. That leaves a lot for the instructor's pocket. Who said this hobby was non-commercial? And non-profit? Is Elmer really dead? Lay some green on my hand and I'll help you into this great hobby of ours! But don't expect me to do it for free. I would have thought an ARRL-sponsored class would be free except for texts. That's how classes are conducted out here. In the ARRL's official meeting they were crying about the technical incompetence of the present day ham. What technical information can be given in 20 hours? Who's kidding whom? The sickness is spreading.

*That's a bunch of carp... Wayne.*

**Jim Giunta WB3HDA, West Chester PA.** I ordered a

Bioelectrifier kit and put it together. I assumed it was just another gadget, so I let it sit on my workbench without trying it. I was sure I'd wasted my money. Then a few days ago, I woke up with a toothache. I decided to try the Bioelectrifier and see what effect it might have. I used it for 20 minutes and the toothache was gone! I don't believe this was a coincidence. I've had toothaches before and I've never known one to simply go away in 20 minutes. The Bioelectrifier works! 

### NEVER SAY DIE Continued from page 4

percentage of their kids go on into high-tech careers as technicians, engineers and scientists. When I visit the research and development labs in Japan I'm greeted by hams at every turn. So we're surrounded by Icom, Yaesu, Kenwood, Sony, Hitachi, Toshiba, Aiwa, Pioneer, Sansui, Alinco, Azden, JRC, Standard, Onkyo, etc.

Of the 700,000 American hams listed in the *Callbook*, I'll bet we don't have 100,000 still active on our HF bands. The FCC keeps us on the books for ten years, even if we've dropped dead or dropped out, so that official number is seriously inflated.

Will you complain that I'm ARRL-bashing if I suggest that perhaps our faith in the League's leadership may be misplaced? Any corporation that produced such a disgraceful performance—such a loss of customer base compared to the competition—would have their board of directors and officers replaced by better performers. The ARRL directors aren't asleep, they're dead! And not only is the hobby hurting as a result, but so is our country. If this is ARRL-bashing, who else is there to bash? It's our only national organization, so we're totally dependent on the quality of its performance for the life of our hobby—and if you feel it's unfair to hold the board of directors responsible for the corporation's performance, then who do you feel is

responsible? You have the proof and it is undeniable. The Japanese are kicking the s...tuffing out of us.

With over three million hams, do you think the Japanese counterpart of our FCC is going to auction off their well-occupied UHF and microwave ham bands? Not a chance.

So what can you do? I explained that a long time ago and it went in one eyeball and out the other. Get some young ham with guts in your club to run for director; get behind him with a vengeance, and help flush the old-timers out of Newington. Let's get some life into our hobby. Let's see some double-digit growth again.

Yes, I've heard all the feeble excuses. Whine, whine, the kids today, etc. Well, the Japanese kids today are going for ham radio in one hellacious way, and they have the same toys we do. In fact, that's where most of our toys are designed and built.

I suppose I should be nice and play it cool so I don't screw up

*Continued on page 39*

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FT-1000



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## Help Wanted: Dayton Youth Forum

New York City—Educator Carole Perry WB2MGP will be moderating the popular Dayton Youth Forum on May 17th. She is looking for articulate, enthusiastic young people (8-18 years of age) who would like to be presenters. Please call Carole at (718) 761-5733 as soon as possible.

## Congress Orders Reallocation of 13-cm Amateur Radio Spectrum

The 104th Congress adjourned October 3, 1996, the day after the Senate concluded its business. Much of the important legislation in the final hours was wrapped into the 2,000-page omnibus budget resolution, HR 4278.

Unfortunately, the following language was included in this bill—now Public Law 104-208. This bill was signed into law by President Clinton on October 4, 1996. Here is the text of the legislation:

### Title III—Spectrum Provisions

#### Sec 3001. Competitive Bidding for Spectrum

(a) Commission Obligation to Make Additional Spectrum Available—

The Federal Communications Commission shall—

(1) reallocate the use of frequencies at 2305–2320 megahertz and 2345–2360 megahertz to wireless services that are consistent with international agreement concerning spectrum allocations; and

(2) assign the use of such frequencies by competitive bidding pursuant to section 309(j) of the Communications Act of 1934 (47 USC 309(j)).

#### (b) Additional Requirements—

In making the bands of frequencies described in subsection (a) available for competitive bidding, the Commission shall—

(1) seek to promote the most efficient use of the spectrum; and

(2) take into account the needs of public safety radio serviced.

#### (c) Expedited Procedures—

The commission shall commence the competitive bidding for the assignment of the frequencies described in subsection (a) (i) no later than April 15, 1997. The rule governing such frequencies shall be effective immediately upon publication in the Federal Register...

#### (d) Deadline for Collection—

The Commission shall conduct the competitive bidding under subsection (a)(2) in a manner that ensures that all proceeds of the bidding are deposited in accordance with section 309(j)(8) of the Communications Act of 1934 not later than September 30, 1997.

What does this language mean? On the surface

it appears to mean that Congress and President Clinton have authorized the 2305 to 2310 MHz segment of our Amateur Band to be transferred into the pool for auction and competitive bidding to commercial interests, and that it will be removed from the Amateur Radio Service. That still leaves the 2300–2305 MHz segment for Amateur operations... at least for the moment. At this time no one knows exactly when the 2305 to 2320 MHz band will be auctioned and if the 2305 to 2310 MHz segment will be removed from Amateur use. The new law requires the competitive bidding to begin within six months.

According to Brad Wyatt K6WR, ARRL Pacific Division Director, the League had worked with the key Congressional members to avoid this outcome—and hoped that they would be successful. During the final two weeks of the 104th Congressional session, "...the ARRL repeatedly submitted written and verbal statements to the key Congressmen asking that Congress stay out of the direct spectrum allocation business as it has in the past." But, it was to no avail.

Congress has now directed that the 13-cm spectrum should be quickly reassigned as part of the budget and deficit reduction process. In short, the radio spectrum represents "big dollars" to the US treasury. Commercial interests have already paid more than \$20 billion to the government in recently held spectrum auctions. And you can certainly expect this trend to continue. "Sell everything in sight," continues to be the policy...

TNX to *The Repeater*, November 1996, which copied it from the *W5YI Report* dated Nov. 1, 1996.

## Worked All Parish Award

Since Louisiana is the only state in the US that uses parishes as its primary political subdivision (instead of counties or boroughs) and Baton Rouge is the capital city of Louisiana, the Baton Rouge ARC has decided to sponsor a Worked All Parish Award. This award is being offered as an effort to stimulate activity on the high frequency bands, and will include an attractive certificate suitable for framing.

Copies of the Rules and Requirements are available by sending an SASE to the BRARC Awards Committee at P.O. Box 4004, Baton Rouge LA 70821.

TNX L. Wayne Gordon K5EOA, President, BRARC.

## Phase 3-D Launch Now Set for July, 1997

Silver Spring MD (AMSAT News Service)—A published report released on Tuesday, December 17th by the European Space Agency (ESA) has shed new light on the planned launch date for AMSAT's phase 3-D international satellite aboard the next flight of the Ariane 5 booster, Ariane 502.

Following a plan of action set in motion last September among ESA, the French Space Agency (CNES) and the firms concerned in building the rocket, a detailed timetable for operations leading up to Ariane flight 502 has now been established by these organizations.

ESA reports that, while each individual operation will require very close analysis, the Ariane 502 launch is now scheduled for early July. The last qualification launch of the Ariane 5, Ariane 503, managed by ArianeSpace, has now been scheduled for November 1997.

AMSAT-NA President Bill Tynan W3XO welcomed the news, saying that, "It gives us a definite goal to shoot for in our preparations of the Phase 3-D spacecraft; however, every month the launch is pushed back means more funds are needed." Bill noted that a letter is currently going out to all AMSAT-NA members asking for additional contributions to the project. He emphasized that, "It is particularly important to the successful completion and launch of Phase 3-D that recipients of this letter respond as generously as they can."

AMSAT is a not-for-profit, 501(C)(3) educational and scientific organization that was first chartered in Washington DC, USA. Its objectives include promoting space research and communications by building, launching and controlling Amateur Radio spacecraft. Since its founding, over 25 years ago, many other like-minded organizations have been formed around the world to pursue the same goals and who now also bear the AMSAT name. Often acting together, these groups have used predominantly volunteer labor and donated resources to design, construct and, with the added assistance of government and commercial space agencies, successfully launch over two dozen Amateur Radio communications satellites into Earth orbit.

The Phase 3-D satellite, now under construction with the help of over a dozen AMSAT groups on five continents, will be the largest, most complex, and most expensive Amateur Radio satellite ever built.

In North America, for more information contact:

AMSAT-North America  
Keith Baker KB1SF, Executive Vice President  
1324 Fairgrounds Road  
Xenia OH 45385-9514 USA  
Phone/Fax: 513-429-5325  
[kb1sf@amsat.org]

In Europe:

AMSAT-Germany  
Werner Haas DJ5KQ, Vice President  
Holderstrauch 10  
D-35041 Marburg, Germany  
Phone: (06421) 684121  
Fax: (06421) 285665  
[dj5kq@amsat.org]  
TNX AMSAT.

## Hams Want Morse Code

The numbers are in, and by a wide margin hams say that they want the Morse code to stay. In a recent survey conducted by the American Radio Relay League, amateurs have made their feelings known. Sixty-two percent of ARRL members polled

said yes to keeping the code, while thirty percent said no. Of all amateurs polled, members and non-members alike, fifty-four percent said yes to keeping the code, while thirty-seven percent said no. In this era of the popular No-Code Tech license, amateurs say no to the total no-code licensing.

The bottom line: In months past, some high-ranking officials have publicly hinted that the ARRL might not be opposed to expansion of privileges for no-code hams. As a result of this survey, when the League goes to WRC '99, it will have to stand its ground. It will be forced to say no to those administrations whose telecommunications leaders say that it's time to delete the Morse code as a testing requirement for getting ham radio voice operating privileges on bands below 30 MHz.

Found in *SARA News*, January 1997, with TNX to *Newsline Radio*, CBBS Edition #1008, 12/6/96.

## FCC Exams 2001?

Considering the general direction in which Amateur Radio seems to be heading and the climate that exists at the ARRL and FCC, I propose the following to be used as the official examination form by the year 2001...

FCC Examination Form For All Classes of Amateur Radio Operation—Jan. 1, 2001. Pick one or more of the answers as appropriate.

- 1) A "ham" is:
  - a. A delectable dish served for Christmas or with eggs for breakfast.
  - b. An uplifting phrase found in operations manuals for Japanese amateur equipment, meaning, "Honorable 'AM'ericans," usually applied to the operators of said equipment.
- 2) A "rig" is:
  - a. A device used to dig wells, usually for water, but if you are lucky, perhaps for oil.
  - b. A device used to send electrical signals around the world. Archaic definition: "used to communicate with CW, RTTY, AM, or SSB."

Note: Since communication has long since ceased to be an objective of amateur radio, we at the FCC will not consider either answer to be incorrect. This is a freebie, not a trick question.

- 3) An "antenna" is:
  - a. A wire strung between the rafters in your attic.
  - b. A "flagpole" with a strange black box attached to the base.
  - c. A large array of tubing, wire and insulating material held from 50 to 200 feet in the air by a device called a "tower." Due to widespread ordinances, these are extremely rare, and found only in the remote corners of the desert Southwest.
- 4) "TVI" is:
  - a. Any form of interference whatsoever that is blamed on the operation of an amateur radio station. This can occur whether the station is on the air or not.
  - b. An abbreviation for the Tennessee Valley Inquisition, a fierce battle for tower rights that took place in the late 1990s.
- 5) "Guy" is:
  - a. A person you meet on the street and ask about the time, as in "Hey, Guy, what time is it?"
  - b. A wire used to hold up a tower in winds of 25 mph or less.

Its use is considered to be optional by most amateur operators.

- 6) "Ground" is:
  - a. What a tower crashes into when the winds reach 30 mph or more.
  - b. What keeps Japan from being Line of Sight from here in the good ole U.S. of A!
- 7) "Packet" is:
  - a. A grand experiment in digital communications that started in the early 1980s but ground to a halt because of too much infighting among SYSOPS.
  - b. Something you put your letters into when you really want the message to get where it is supposed to go. Stamps are applied to the outside of this packet and in a few days it arrives at its destination. Just like magic!
- 8) A "computer" is:
  - a. A device that has lured potential amateur radio operators away from the hobby by the thousands.
  - b. An enormous waste of time and energy, but, like women, "Ya can't live with them, ya can't live without them!"
- 9) A "printer" is:
  - a. Someone who works for the newspaper.
  - b. A device attached to a computer to accurately translate the tones received from the sending station into all the typos, misspellings and grammatical errors as they were originally entered by the operator.
- 10) "Electronics" is:
  - a. A mystical art that no one understands anyway, so why try to define it?
  - b. All of the above.
  - c. None of the above.

Congratulations! If you gave any answer at all to 70% of the questions above, you are worthy of becoming an amateur radio operator. Just fill out the form on the other side of this exam and send it in to the FCC offices shown at the bottom of the form.

TNX Q-Fiver, January 1997, who got it from K14QJ BBS, who got it from Jim Stanicek AG3Y, who hopes that none of the above will be true in 2001!

## FCC Plan Would Ease International Operating

The FCC has proposed amending the Amateur Radio rules to make it easier for hams holding a European Conference of Postal and Telecommunication Administration (CEPT) radio-amateur license or an International Amateur Radio Permit (IARP) from certain countries in Europe and the Americas to operate during short visits to the US. If finally approved, hams would be able to operate for short periods in participating countries without first obtaining another license or permit from the host country.

The FCC says the arrangement is intended to make it easier for US hams to operate stations temporarily in several countries in Europe, Central and South America. Likewise, hams from those countries would be allowed to operate stations in places where the FCC regulates ham radio. "We believe that US participation in both the CEPT agreement and the CITEL/Amateur Convention would benefit US amateur operators who travel to Europe and to

the Americas," the FCC said in its discussion of WT Docket 96-188.

Operating authority by CEPT or IARP holders in the US would be for "up to 180 days within the preceding five years." The two classes of CEPT licenses would correspond either to Amateur Extra or Technician class. Resident aliens or US citizens could not operate in the US under a CEPT license or IARP.

Last year, ARRL petitioned the FCC to implement the CITEL/Amateur Convention. The League also asked the Commission to acknowledge arrangements to be made between the ARRL and the Department of State to issue IARP documents to US citizens for use in other CITEL countries. The FCC has asked the State Department to apply for participation in the CEPT Agreement as a non-CEPT country and expects the agreement to be concluded this year.

E-mail comments should mention "WT Docket No. 96-188" on the subject line and should be addressed to [mdepoint@fcc.gov](mailto:mdepoint@fcc.gov). Include your full name and Postal Service mailing address in the message text. Mail written comments to: Office of the Secretary, Federal Communications Commission, Washington DC 20554—de FCC.

From *CARS, The Clearwater Connection*, October, 1996.

## There's a Moral Here...

"Well, hello, Doug, good to see you. We've been trying to reach you for several days now!"

"That's interesting, Mike. I don't understand why. I have a telephone, call waiting, call forwarding, caller ID, an answering machine, a pager, facsimile machine, E-mail, all the amateur radio bands from 160 to 2 meters, packet radio, slow scan TV, and, of course, my portable cellular phone!"

"Sorry, Doug, but I simply rang your front doorbell. It must not be working!"

TNX KB8QLT, from March 1997's *Tuned Circuit*, monthly bulletin of the L'Anse Creuse ARC. **75**

## Radio Bookshop

Phone 800-274-7373 or 603-924-0058, FAX 603-924-8613, or see order form on page 88 for ordering information.

### Rene's Books

**NASA Mooned America.** René makes an airtight case that NASA never landed anyone on the moon. Ridiculous, of course, so maybe you can be the first to find fault with René's 30 "gotchas." He sure convinced Wayne. \$25.

**The Last Skeptic of Science.** René blows holes in one cherished scientific dogma after another. Do you believe there have been ice ages? That the moon causes the tides? That the iron core of earth causes its magnetic field? That the transmutation of elements is difficult? Another \$25 well spent.



# Build an Audio Multiplexer for Your Frequency Counter

*Count CTCSS tones without expensive commercial equipment.*

Roland Burgan KB8XI  
RR1, Box 43  
Hancock MI 49930  
rburgan@up.net

**T**ired of struggling with low-end audio frequency counter readings, but not ready to shell out money for an expensive audio prescaler? Here's a much cheaper alternative.

## The problem

Obtaining an accurate reading of repeater CTCSS (Continuous Tone Coded Squelch System) or tone-burst audio

tones can be very difficult. If the counter's gate time is set to read out to 0.1 Hz, then usually the acquisition time required is too long. If the gate time is shortened as much as possible, the accuracy

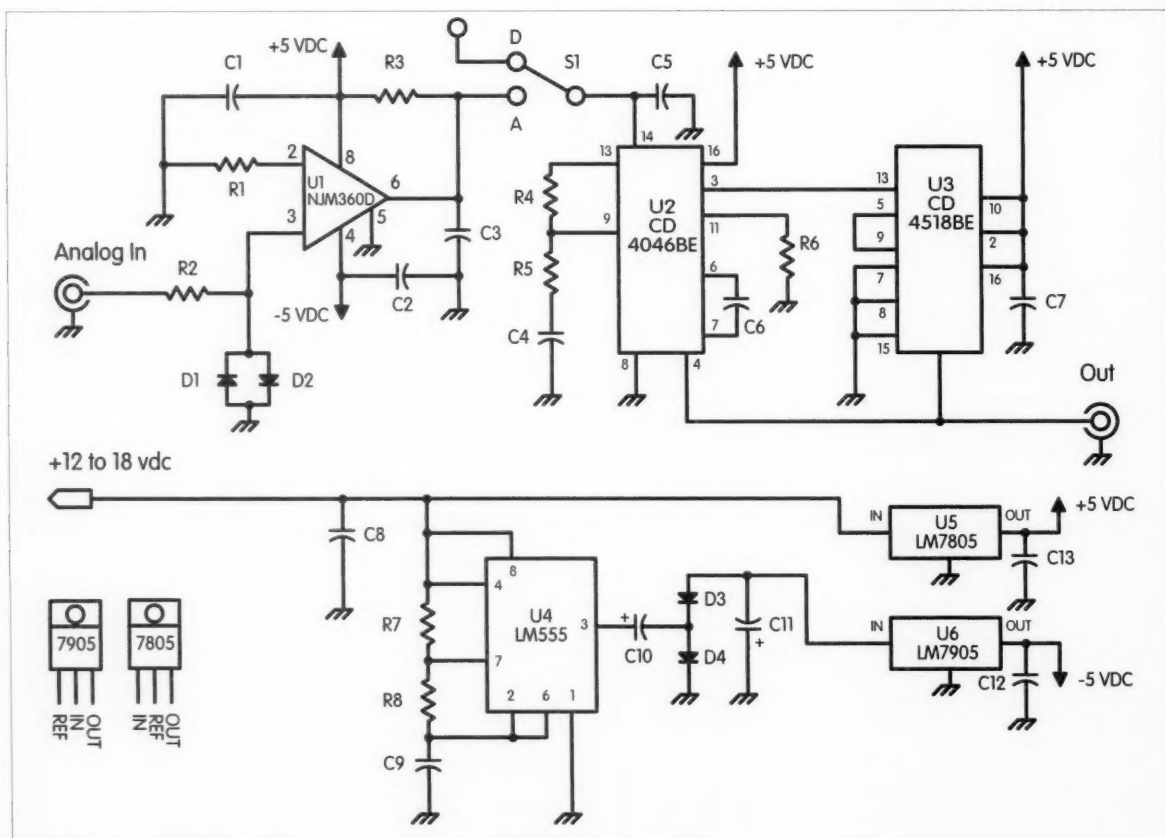
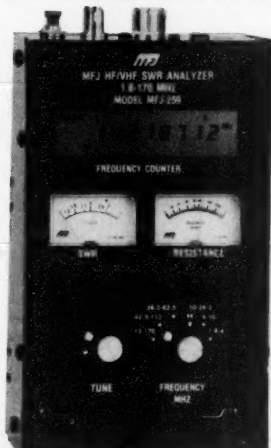


Fig. 1. Schematic for the Audio Multiplexer.

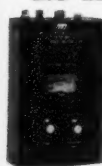
# MFJ HF/VHF SWR Analyzer™ with RF Resistance Meter

Read your antenna SWR from 1.8-170 MHz... 10-digit LCD frequency counter... RF Resistance Meter™... smooth reduction-drive tuning... simple-to-use...



**MFJ-259**  
**\$239.95** If you work with antennas, MFJ's revolutionary new SWR Analyzer™ is the best investment you'll ever make! Now you can diagnose a wide range of antenna problems instantly with one easy-to-use instrument.

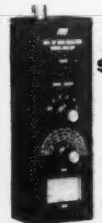
## 1.8-170 MHz SWR Analyzers™



**MFJ-249** **\$219.95** MFJ-249 HF/VHF SWR Analyzer™ has all the features of MFJ-259 but less RF resistance meter. Includes 1.8-170 MHz continuous coverage, 10-digit LCD frequency counter and smooth vernier tuning.



**MFJ-209** **\$109.95** MFJ-209 HF/VHF SWR Analyzer™ is same as MFJ-259 without LCD frequency counter and RF resistance meter. Has jack for external frequency counter. MFJ-249/MFJ-209 are 4x2 1/2 x 6 3/4 inches and uses 8 AA cells or 110 VAC with MFJ-1312B, \$12.95.



**10-160M SWR Analyzer™**  
**MFJ-207** **\$79.95** If you're an HF man, this compact MFJ-207 HF SWR Analyzer™ will help you build 10-160 Meters antennas that'll make working DX almost routine.

Just plug in your coax to find the SWR of any HF antenna on any ham band 10-160 Meters. Has jack for external frequency counter. 7 1/2 x 2 1/2 x 2 1/4 inches.

## Bandswitch Dip Meter™



**MFJ-203** **\$99.95** The MFJ-203 is a sensitive Bandswitched Dip Meter™ that covers all ham bands from 160-10 Meters. There are no plug-in tuning coils to keep up with or break.

Has detachable coupling coil, dual FET oscillator, op-amp meter amplifier and jack for external frequency counter. 7 1/2 x 2 1/2 x 2 1/4 in.

**What the MFJ-259 Does**  
The MFJ-259 gives you a complete picture of your antenna's performance anywhere between 1.8 and 170 MHz -- you can even check SWR outside the ham bands without violating FCC rules. Set the bandswitch and tune the dial--just like your transceiver. SWR is displayed instantly!

## RF Resistance Meter™

**Does 2:1 SWR mean 25 ohms or 100 ohms? The new MFJ-259 tells you at a glance!**

Now you can measure RF resistance up to 500 ohms at minimum SWR -- instantly -- on MFJ's exclusive side-by-side RF Resistance and SWR Meters!

Take the guesswork out of building matching networks and baluns for your antennas.

Watch the effects of spacing on radiation resistance as you adjust your antenna.

## Here's What You Can Do...

Find your antenna's true resonant frequency from the shack.  
Tune the antennas on your

tower and watch SWR change instantly as you make each adjustment. You'll know exactly what to do by simply watching the display.

Tune critical HF mobile antennas in seconds -- without subjecting your transceiver to high SWR.

Measure your antenna's 2:1 SWR bandwidth on a single band, or analyze multiband performance over the entire spectrum from 1.8 to 170 MHz!

Measure inductance, capacitance, resonant frequency of tuned circuits, transmission line velocity factor/impedance/loss. Test RF chokes, transformers, baluns.

Adjust your tuner for a perfect 1:1 match without creating QRM.

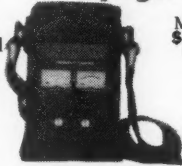
And this is only the beginning!

The MFJ-259 is really four test instruments in one: an accurate RF signal generator, a high resolution 170 MHz frequency counter, RF Resistance Meter™ and an SWR Analyzer™.

## Free Manual

MFJ comprehensive 18 page instruction manual is packed with useful applications -- all explained in simple language you can understand!

## Carrying Pouch with Window

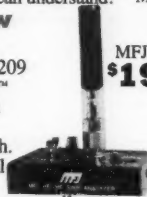


**MFJ-29B** **\$24.95** Tote your MFJ-259/249/209 SWR Analyzer™ anywhere with this custom Carrying Pouch.

Made with a special foam-filled fabric, it cushions blows, deflects scrapes, and protects knobs, meters and displays from harm.

Clear protective frequency display window and cutouts for knobs let you use it without taking it out of pouch. Fully-adjustable webbed fabric carrying strap has snap hooks on both ends. Wear around waist or over shoulder.

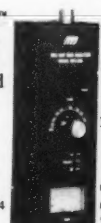
Keep your analyzer safe and looking new! MFJ-29, \$19.95, no window or cutouts.



**MFJ-66** **\$19.95** Plug a dip meter coupling coil into your MFJ SWR Analyzer™ and turn it into a sensitive and accurate bandswitched dip meter.

With a dip meter you'll save time and take the guesswork out of winding coils, measuring inductance and capacitance, measuring velocity factor and electrical lengths of coax. Determine resonant frequency of tuned circuits and measure Q of coils. Set of two coils cover 1.8-170 MHz depending on your MFJ SWR Analyzer™.

**Free MFJ Catalog**  
Write or call... 800-647-1800

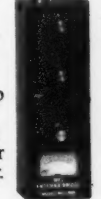


**2 Meter SWR Analyzer™**  
**MFJ-208** **\$79.95** MFJ-208 2 Meter VHF SWR Analyzer™ finds the SWR of any antenna from 138-156 MHz. Jack for external frequency counter. 7 1/2 x 2 1/2 x 2 1/4 inches.

## For Commercial VHF Radio

Same as MFJ-208 but for commercial VHF. MFJ-217, \$79.95, covers 30-50 MHz and MFJ-218, \$79.95, covers 150-170 MHz.

## MFJ Antenna Bridge



**MFJ-204B** **\$79.95** Great for determining feedpoint resistance of antennas and for designing impedance matching networks. Measure RF resistance up to 500 ohm. Covers all ham bands 160-10 Meters. Built-in resistance bridge, null meter, tunable oscillator-driver, frequency counter jack. 7 1/2 x 2 1/2 x 2 1/4 inches. Use 9 volt battery or 110 VAC with MFJ-1312, \$12.95.



## 440 MHz SWR Analyzer™

**MFJ-219** **\$99.95** Read SWR of any antenna 420 to 450 MHz -- just plug coax of your antenna into SO-239 connector, set frequency and read SWR. Uses microwave integrated circuits and microstrip technology. Jack for external frequency counter. 7 1/2 x 2 1/2 x 2 1/4 in.

MFJ-219N, \$99.95, same as MFJ-219 but with "N" connector.

MFJ-219/218/217/208/207/203 uses 9 volt battery or 110 VAC with MFJ-1312B, \$12.95.

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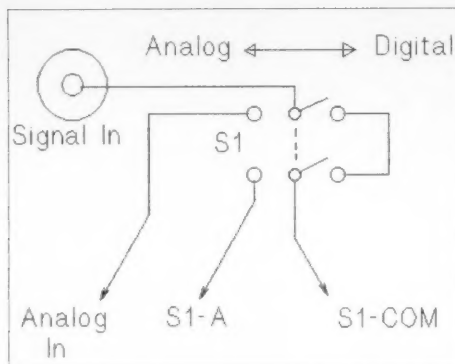


Fig. 2. For a single input, change S1 from an SPDT to a DPDT.

often proves inadequate. Until now, you had to buy either a more expensive counter or an expensive preprocessing unit to achieve the desired readout. But there is a way around the problem.

#### The solution

If we were to multiply the low frequency audio by 100, we could then get the desired digit accuracy in a fast

+5 VDC to the rest of the circuit. Switch S1 provides for selection of analog (sine) input, or for TTL/CMOS square wave signals.

#### Construction

All parts are standard values, and are available from a variety of parts sources. C5 can be two .01  $\mu$ F in parallel. Although the Audio Multiplexer may be wired point-to-point, the use

is fed back to the U2 error input, pin 3, through the multiply-by-100 dual decade up-counter, U3, a CD4518BE, forcing the U2 VCO (voltage-controlled oscillator) to produce an output 100 times the original PLL input frequency (pin 14). A -5 VDC power requirement for U1 is met by U4, a 555, operating as an oscillator, whose output is rectified to produce the negative voltage. U6, a negative voltage regulator, provides -5 VDC. U5 provides a regulated

**Parts List**  
(Unless specified otherwise, resistors are 1/4W and capacitors are in  $\mu$ F.)

R1	100
R2	2.2k
R3	3.3k
R4	1M
R5	47k
R6	4.7k
R7	1k
R8	10k
C1-C3, C7, C12, C13	0.1
C4	2.2/16V
C5	.02
C6	22 pF
C8	220/25V
C9	.047
C10	47/25V
C11	10/25V
D1, D2	1N914
D3, D4	1N4001
U1	NJM360D (hi-speed comparator)
U2	CD4046BE (phase-locked loop)
U3	CD4518BE (up-counter)
U4	555
U5	(LM)7805 (+5 regulator, 1A)
U6	(LM)7905 (-5 regulator, 1A)
S1	SPDT switch

Hardware, case, connectors

Parts available from  
Mouser Electronics (East)  
1-800-346-6873.  
PC board available from FAR  
Circuits, 18N640 Field Ct.,  
Dundee IL 60118; (847) 836-9148.  
\$5.50 each +\$1.50 S&H per order.  
Visa/MC accepted with \$3.00  
service charge per order.

time gate. We would only need to place the decimal point properly. Since shortening the gate time reduces the accuracy by one decade counter each step (a factor of ten), shifting the signal up times 100 restores the lost digit accuracy at the fast gate. It also adds another digit of accuracy, giving 0.1 Hz readings in the fast gate mode. The Audio Multiplexer will upconvert incoming audio frequencies through a range of 20 Hz to 8,000 Hz (8 kHz), and provide a TTL (transistor-transistor logic) output level. The unit may be powered from any single DC supply from 12 to 18 VDC.

#### The circuit

The circuit diagram (Fig. 1) shows the input analog signal fed to a voltage limiter (R2, D1, D2) to allow inputs to 50 VAC. U1, an NJM360D hi-speed comparator, amplifies and converts an incoming signal as low as 10  $\mu$ V to a TTL signal. The TTL signal then goes to U2, a CD4046BE PLL (phase-locked loop). The output of U2, pin 4,

of a printed circuit board is recommended (see Parts List). A metal box is recommended if the unit is to be used near transmitters. The choice of input/output connectors is left to the builder. Although the main schematic (Fig. 1) shows a split input, a single input may be used by changing S1 from an SPDT Switch to a DPDT (see Fig. 2). If +5 VDC and -5 VDC is already available, make appropriate connections at the connection points marked +5 VDC, and, -5 VDC. U4, U5, U6, and associated power supply components can then be eliminated.

#### Use

With no circuit adjustments to make, operation is simple. Just connect power, an audio source (below 8 kHz) to the input, and a frequency counter to the output. Use S1 to select sine/square input waveform. Remember to mentally adjust the decimal point two places to the left on the counter readout. Shielded cable is recommended for inputs, to minimize external noise.

73



# Build the Bioelectrifier

*Can you heal yourself and take a poke at the medical establishment at the same time?*

Thomas M. Miller WA8YKN  
314 South 9th Street  
Richmond IN 47374

Back by popular demand, this article is reprinted—with a new addendum—from May 1996.

One of the first things a new amateur learns is that electricity and biology are not very compatible. A brush with the AC line can be a painful experience, and accidental contact with the high-voltage supply of a large transmitting tube can be fatal. Because of this early training, occasionally reinforced by an unpleasant accidental jolt, it might surprise some hams that tiny electrical currents can be beneficial to the human body.

For some time, doctors have known that passing a small current through a broken bone will cause it to heal faster. Damaged tendons and nerves also seem to respond to this treatment. Exactly why this works is not known, although a doctor once explained to me that it seemed to focus the body's attention on the area.

Recently, doctors at the Albert Einstein College of Medicine reported discovering that passing a current of

only 50 microamps through the blood can prevent certain viruses, notably the HIV virus, from replicating. The current became even more effective when the polarity was reversed several times a second. The implications are enormous.

Unfortunately, there has been very little interest in this phenomenon by the medical community. Those of us who read Wayne Green's editorials have become aware of a simple device which introduces a small electrical current through the legs by placing electrodes on the ankles. Since the arteries in the legs are large, and the blood has less electrical resistance than the surrounding tissue, this technique results in most of the current flowing through the blood. This is an ideal approach for amateur experimentation, since it is totally external, and the required voltage and current levels are so tiny as to pose no danger. I decided to design such a device, using a simple printed circuit board, and easily

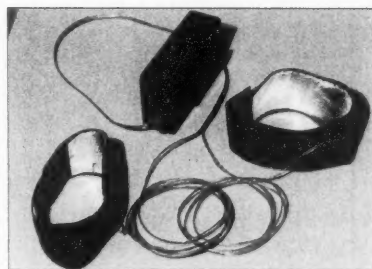


Photo A. The Bioelectrifier with belt clip and ankle electrodes.

obtained parts, so that it could be duplicated by other amateurs.

At this point, let me state that I make no medical claims for this device. To paraphrase a famous Chief Medical Officer, I'm an engineer, not a doctor. Since very few doctors are electronics experts, there are many who would love to research the possibilities of this approach to eliminating viruses in the blood, but are unable to build the needed experimental device. They need your help.

So I present this circuit for those wishing to help doctors experiment in an unknown field, and also as an interesting study in design and construction.

## Designing a Bioelectrifier

Before attempting to design any device, it's a good idea to make a list of goals. In this case, it's a simple list:

- (1) The device should produce a current flow of 50 microamps from one ankle to the other. Experimentation has shown that this requires 30 to 35 volts.
- (2) It must be capable of reversing the current flow several times per second. This rate should be adjustable.
- (3) It must be all solid-state—no DPDT relays clacking away, eating up the batteries.

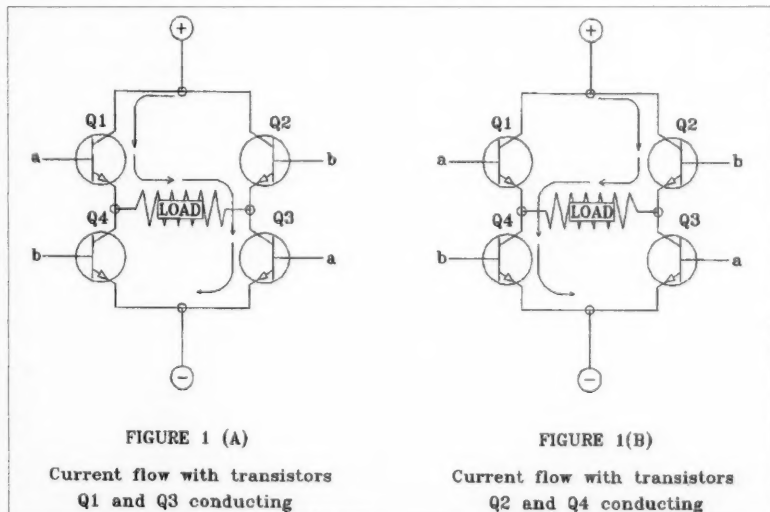


Fig. 1. Four transistors are used to reverse the current flow by being energized in pairs.

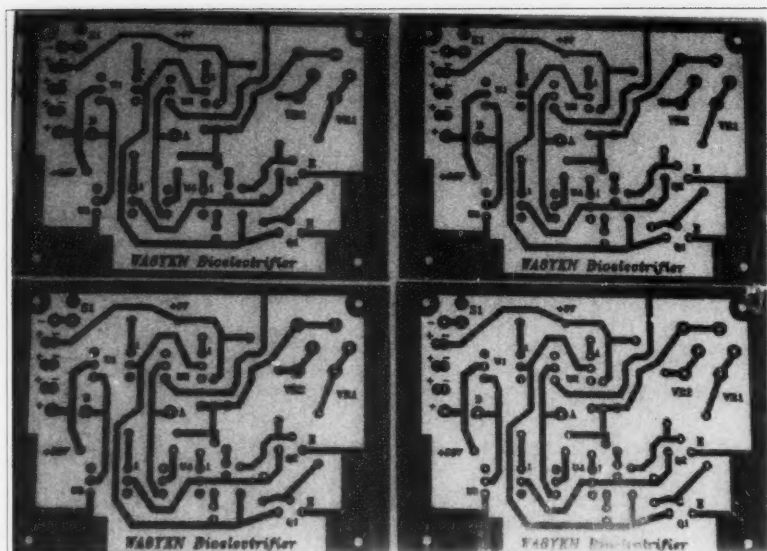


Photo B. Four circuit boards are etched on a single piece of copperclad and are cut apart after drilling.

(4) It must be small, light, and easy to carry. The ideal form would look like a pocket pager.

(5) It must have a low current drain for long life from small batteries.

(6) It must be as simple and inexpensive as possible, so that it may be easily reproduced.

This last goal is one of the most important in designing any device or circuit. It is, in fact, Occam's Razor, a corollary which states that when there are many ways to solve a problem, the best solution is the simplest one.

At first glance, it would be tempting to

use logic chips, or perhaps a 555 timer and a flip-flop to get a variable timebase with an equal on-off ratio. However, this direction leads to a regulated power supply, high current drain, and a complex circuit. Also, logic chips will not switch 35 volts without an additional driver stage. Remember rule number six... the simplest way!

Maybe we'd be better off starting from the other end. Reversing polarity requires the solid-state equivalent of the DPDT relay. As it turns out, there is just such a circuit commonly used to drive

and reverse DC motors. It uses four transistors in an "H" configuration, the load being in the center (see Fig. 1). When transistors 1 and 3 conduct, the current flows in one direction, while energizing transistors 2 and 4 reverses the flow. Most small switching transistors will stand up to our requirement of 35 volts at 50 microamps, but here we run into a new problem. For each direction, two transistors are in series, with the load in the middle. This creates a difficult bias arrangement to drive both transistor bases equally. Fortunately, there is a neat solution—the optocoupler. This invaluable device contains an LED and a phototransistor in one package. Energizing the LED produces light, which causes the phototransistor to conduct. No base voltage is required, therefore there are no bias requirements. Optocouplers are usually used to drive another device, but our requirements are so small that we can use them as output transistors.

The cheapest optoisolators cost less than a dollar and will withstand over 30 volts with current ratings in the hundreds of milliamps. For a few cents more, optocouplers are available that will withstand 80 volts or more.

With four optocouplers in the output of our device, all that remains is to alternately drive them in pairs. The simplest circuit to accomplish this is the multivibrator—nothing more than two general-purpose transistors, two resistors, and two capacitors. Voltage is not at all critical, and since we will be connecting batteries in series to get 35 volts, we can tap off at the 9 volt point to power the circuit. While we're at it, adding two more resistors and two tiny LEDs will give a visible indication of circuit operation and warn us when the battery goes dead.

Varying the frequency of a multivibrator requires that two resistors be varied together...no big deal. Two-gang potentiometers are ideal for this. In fact, our design goals do not specify that an equal duty cycle is required, or even desired. Two trim pots will give independent adjustment of the two states if this is needed. A fixed resistor in series with each pot will establish a maximum frequency limit, preventing the circuit from dropping out of oscillation when the pot is adjusted all the way.

We now have the basis of a simple,

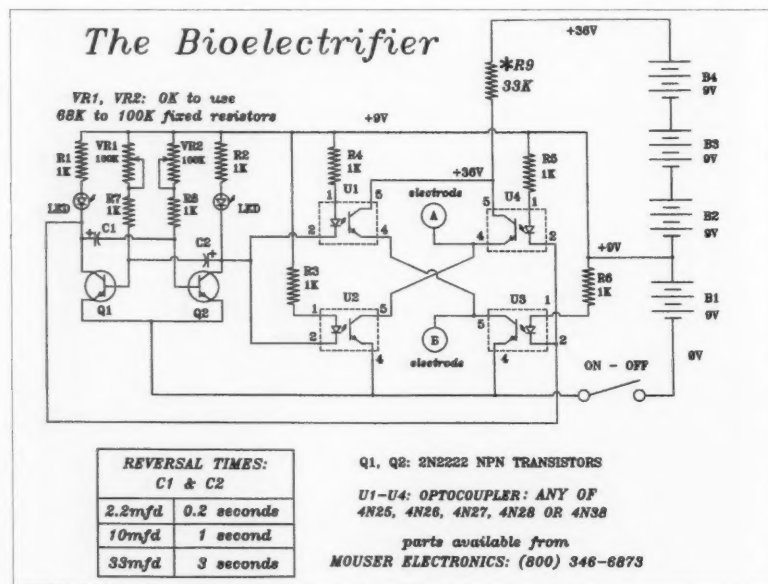
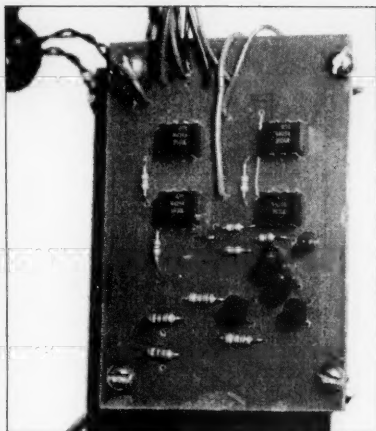


Fig. 2. Schematic diagram of the Bioelectrifier.



**Photo C.** The Bioelectrifier – component side of the board.

practical design: four optocouplers, two transistors, one dual pot, two capacitors, two LEDs, and eight resistors, all of the same value! The schematic diagram is shown in Fig. 2. Of course, we will have to add a box, switch, and batteries, and some sort of electrodes. We also need a name. Since we are experimenting in bioelectrics, let's call it the Bioelectrifier!

### The printed circuit board

When designing a printed circuit board for this type of project, a compromise must be made between size and ease of construction. The board should be single-sided with as few jumpers as possible, and there should be enough room for 1/4 watt resistors, in case the smaller 1/8 watt are not available. The final design is shown in Fig. 3.

In my work, I design and build a lot of prototype circuits, and I've settled on an easy technique for circuit board fabrication. I use a Computer Aided Design (CAD) program to create the actual pattern, and then use the computer to generate a mirror image. If the board is small, as in this case, I will then copy this mirrored pattern to get the maximum number of circuits from a standard positive pre-sensitized copperclad board. This mirrored array is shown in Fig. 4. After printing this pattern, I copy it with a standard copy machine and inspect the copy for places where the toner is less than pure black. These areas, if any, are touched up with a felt-tip marker. When I've got a pattern that will give a good, pure black copy, I run two or three

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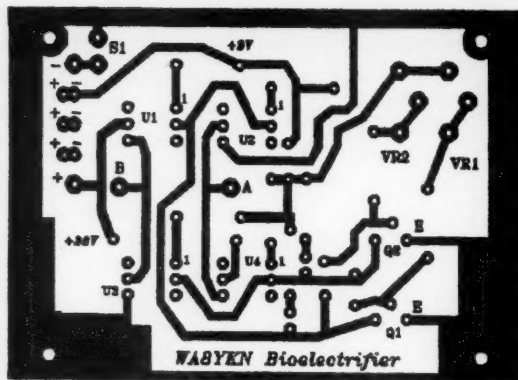


Fig. 3. The circuit board pattern, shown actual size.

copies to warm up the drum, then make a final copy on clear Mylar, sold in office supply stores for making overhead projector displays. It may be necessary to set the copy machine one step darker than normal, since machines tend to vary in how well they work with Mylar. This copy can be used as a positive for printing the circuit board.

Using a standard (4.5" by 6.5") presensitized board, place the Mylar sheet with the circuit board pattern *toner-side down* on top of the board. (The writing should be correct—not reversed!) Place a piece of glass over the Mylar to hold it in contact with the board, and expose it for three and a half to four minutes using an Ultra Violet sunlamp 12 inches above the board. Be sure to protect your eyes during the exposure!

After the board is exposed, dunk it in the developer until all the copper between the traces is shiny and clean; this usually takes around two minutes, but you really can't overdo it. Rinse the board with cold water, and it's ready to etch.

I etch my boards with ferric chloride solution in a tall, thin plastic tank that allows the board to stand up vertically. The use of an aquarium heater and air pump will cut the etching time in half. Do *not* get the etching solution on anything made of metal—it will corrode badly. It also stains everything, so wear rubber gloves and be careful!

After etching, clean the etch resist from the board, polish with steel wool, and drill the holes. The individual patterns can be cut from the board using a bandsaw, jigsaw, or even by hand with a hacksaw if that's all you have. You now have not one, but four circuit boards ready for construction.

## Building the Bioelectrifier

Fig. 5 shows the parts layout for the Bioelectrifier. Be sure to install the optocouplers correctly. Also, the very small LEDs often do not have a flat spot to indicate the cathode, but instead have one lead shorter than the other. Check before cutting the leads! The long lead connects to the dropping resistor.

There are two ways that this circuit can be built. For experimentation, the device can be mounted in a larger box, potentiometers used to vary the frequency and current, and perhaps even a microammeter to monitor the current. However, I've discovered that it's not always wise to give a device with many controls to a non-technical person, especially if changing any of the adjustments would nullify the experiment. Also, we want a pocket-sized device, or one that can be clipped to the belt. Once the operating parameters are established, the resistance of the potentiometers can be measured and the pots replaced with fixed resistors (I used 68k). This makes a much smaller package possible, with only a single on/off switch and two tiny LEDs on the outside. I built one in a 2 7/16" by 5-1/16" plastic box (Radio Shack 270-233) and mounted the switch and LEDs in the end. Four 9 volt batteries would not fit in this box, but one 9 volt and two 12 volt "N" batteries will fit with no problem, and produce 33 volts. Radio Shack sells 12 volt alkaline "N" batteries in a package of two, (23-154) and "N" battery holders (270-405).

I made a belt clip from a strip of steel banding material and glued it to the back. I also glued a two-pole terminal strip to the end of the box to connect the electrode leads, although a plug and jack would be fine. I used what I had on hand.

Electrodes for the prototype were simply strips of aluminum foil, folded to form two strips several layers thick, 2 inches wide and 12 inches long. Wrapped around each ankle, the foil was held in place by rolling the socks up over it. Later, a better electrode was made by gluing aluminum foil to strips of cloth-backed vinyl

upholstery material, with hook-and-loop fastener material glued to the ends.

In either case, connect two 36-inch lengths of hookup wire to the Bio-electrifier's output terminals, and solder a paper clip to the other end of each wire. Slip one paper clip over each electrode, clip the Bioelectrifier to the patient's belt, and your doctor is ready to go.

### OK, it's done. Now what?

Even if your doctor doesn't know anyone with the HIV virus, there are many experiments he can try with the Bioelectrifier. If it works on the HIV virus, what about others, such as those responsible for herpes, Epstein-Barr, colds, and flu? Will a few minutes a day actually *prevent* colds and flu? What effect will different frequencies have? The long-term benefits can only be determined by experimenting and recording the data.

It is interesting to note that all animal life on earth has evolved in the magnetic field of the planet. Blood, being mostly water and containing salts and iron, must generate a tiny voltage as it moves through this field. Is this voltage necessary for good health, and can it be disrupted by exposure to much more intense 60 Hz electromagnetic fields?

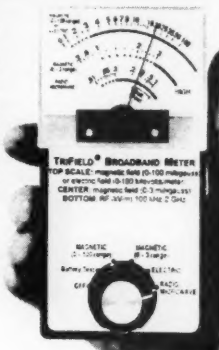
I've often wondered, as we think about manned missions to other planets, if we will one day discover that we cannot live for a great length of time without the Earth's magnetic field. So far, only a few people have ever left the planet, and only for a short time. These astronauts, however, have found that after a few days in space, the immune system starts to shut down! No one has yet found a good explanation for this. Perhaps a small application of bioelectrics is in order!

One interesting result reported by Wayne Green was that when his friend Beck used a similar device for two hours a day instead of the usual 20 minutes, just to see if there might be any harmful effects, he started losing weight! The weight loss continued until he reached his normal weight, then stopped. Since, as Wayne has repeatedly noted, many hams appear to be "eleven months pregnant," this could be the biggest thing since FM! Perhaps this device will open new fields of communication. Just adjust the frequency to match the 7 Hz resonant frequency of the Earth and tune your brainwaves to Dr. Jung's Universal Consciousness!

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All kidding aside, there have been enough results from experiments to date to warrant serious study, and, as usual, mainstream science will continue to ignore it, while sucking up government funds for expensive and ineffective research. But breaking new ground is the amateur's forte. We have the technical skills and the manpower. Keep in mind that every new field is pioneered by amateurs—since the professionals do not yet exist!

One final caveat... *do not* build Bioelectrifiers and sell them as medical devices! This will surely bring unwanted attention from the wrong people. After all, these days even the U.S. Department of Health and Human Services has a S.W.A.T. team! So build it, work with a doctor to experiment, and make sure to keep careful records. Don't even give one away to someone who wants to try it but doesn't have the skills to build it, unless you have no qualms about opening yourself to almost unlimited liability. Remember, the FDA and several other government agencies have unlimited funds to persecute you, and they love nothing better than the slightest excuse to appear to be working. The last thing you need is to get the attention of the bureaucrats, who would probably protect the interests of the pharmaceutical cartels by

outlawing bioelectricity, requiring us all to wear grounding straps on our behinds.

#### ANSWERS TO FREQUENTLY-ASKED QUESTIONS [NEW]

*The response to the Bioelectrifier has been incredible. It's been a year since the original article saw print, and I can still count on a stack of letters every week. This stack becomes a flood whenever Wayne guests on the Art Bell show. Since there are common threads to many of these letters, I thought I should address some of the most frequently asked questions.*

*Bare circuit boards for the Bioelectrifier are available from FAR Circuits, 18N640 Field Court, Dundee IL 60118. And no, the phone has NOT been disconnected... the Chicago suburbs were assigned a new area code. Fred's number is (847) 836-9148.*

*Unlike the Rife devices, this circuit achieves its effect with direct current. However, the polarity must be constantly reversed because the body tends to quickly "charge up" and the current flow drops off. The frequency does not seem to make much difference, and I've used rates from 20 Hz down to 0.2 Hz successfully. One fellow sent me a very long table of resistor-capacitor values*

*and wanted me to fill in the frequency for each combination! (Yes, he was a ham.) The time constant will vary slightly with the leakage of the transistors, but you can get very close by multiplying MEGOHMS by MICROFARADS to get time in SECONDS.*

*The original ankle cuffs lined with foil made a good "field expedient" electrode, but after a time, the foil becomes wrinkled, and the resulting hot-spots feel like tiny critters nibbling at your ankles. An alternative is to line the cuffs with 2-inch-wide heavy stainless-steel tape, available from any auto parts store, or by mail from J.C. Whitney. This material is heavy and polished, and doesn't wrinkle easily. It's also possible to take the advice of Dr. Hulda Clark and wrap a layer of saltwater-dampened paper towel between the metal surface and the skin. If the electrodes are working properly, you can't feel 100 microamps.*

*By far the best alternative is the disposable EKG electrode. These are "peel-and-stick" with a non-messy conductive jelly. These are so good that you can get two to three times the current flow and not feel a thing! They are available from your doctor or chiropractor, or you can order them through your pharmacist. EKG leads are*

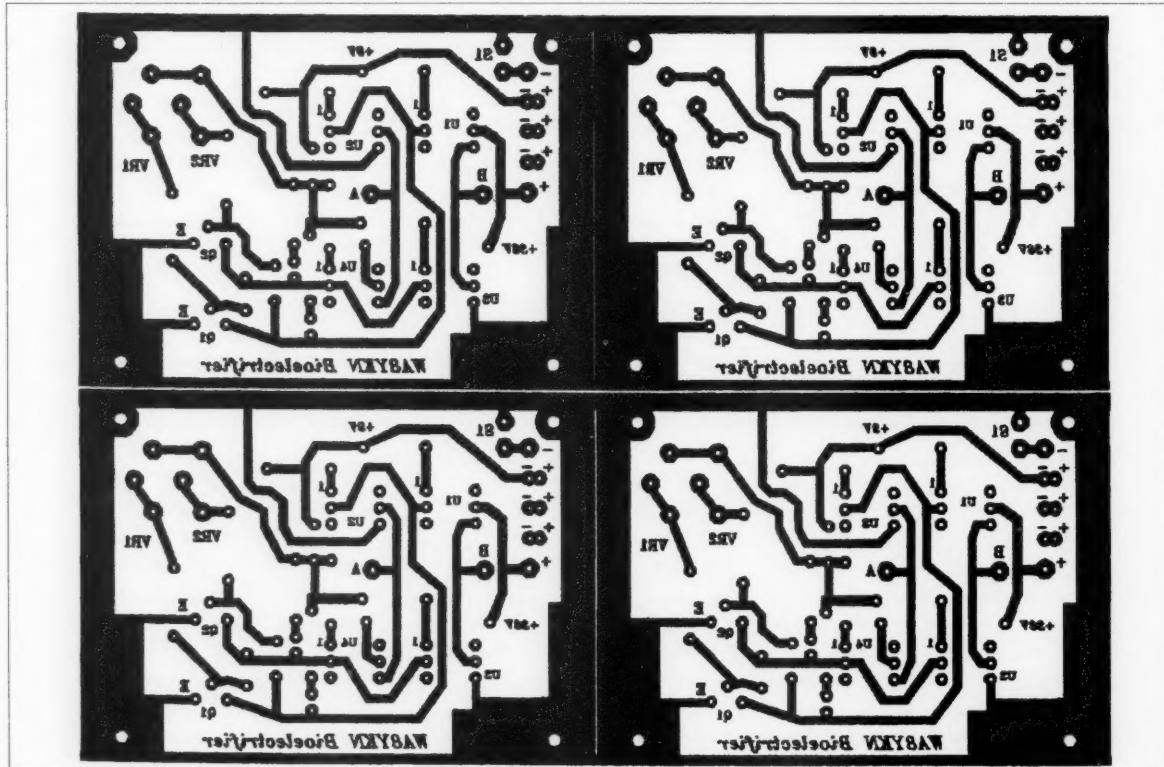


Fig. 4. Make your own "positive" by copying this mirrored pattern onto clear Mylar. Shown actual size.



## Bioelectrifier parts layout

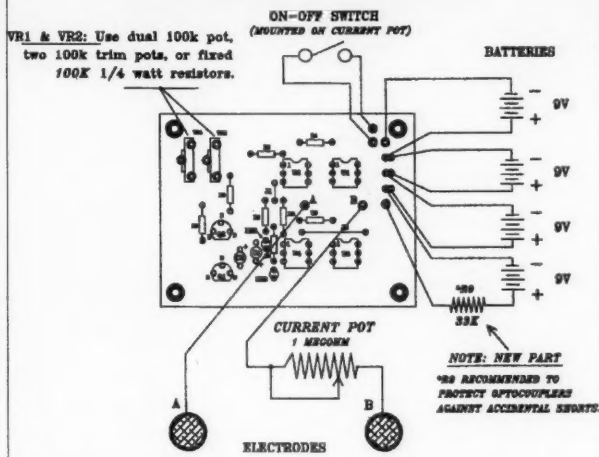


Fig. 5. Component side of the board, showing the component locations and connections.

made to snap onto the electrode, but small alligator clips work just fine.

If you write to me for information, please include a business-size SASE. My updates are now running three pages, so a post card won't do it.

While I can answer questions about

Bioelectrifier Parts List		
Part(s)	Mouser #	Radio Shack #
2 Transistors	333-PN2222	276-2009
4 Optocouplers	512-4N38	—
2 LEDs	351-3001	276-026
1 Dual Pot	31VA501	271-1732
2 4.7µF Capacitors	140XRL16V4.7	272-1024
8 1k Resistors	299-1k	271-1321
1 9V Snap	12BC310	270-405
2 "N" Holders	12BH510	270-405
1 Meg Pot	—	271-211
1 33k Resistor	—	271-1328

Box, switch, batteries, etc.

### Materials for Circuit Boards

Materials for making your own printed circuit boards are available from Circuit Specialists: (800) 528-1417

Part	Number
Sensitized Boards	PP114
Developer	Posdev
Etchant	ER-3

Green's AIDS booklet. Also, Dr. Bob Beck lectures all over the country, leaving a trail of informative audio tapes and written reports in his wake. By the way, Robert C. Beck, D.Sc. and Robert O. Becker, M.D. are NOT the same person!

An important point brought up by Dr. Beck is that when using any bioelectric device, it's necessary to stay away from toxic drugs, alcohol and even herbs. An effect called **ELECTROPORATION** can increase the effect of these chemicals and cause toxic effects from a normally harmless dose. Dr. Beck also stresses the importance of drinking lots of pure water before, during and after using any bioelectric device.

I hope that readers will share the results of their experiments with the Bioelectrifier. You can write to me, or send me E-Mail at [thomil@infocom.com]. My Web site [http://www.infocom.com/~thomil/] is a good place to watch for new information, which I will post as it arrives.

—Thomas M. Miller WA8YKN

### NOTE FROM W2NSD/1

I would make a lot more noise about this except for two things. Make that three. First, I'm not an MD, so the medical industry will probably have no interest in anything I have to offer. Second, efforts to try and bring down the cost of medical treatments could easily trigger an FDA attack and prison. Third, I need more people to call or write to say they used it with success. I've never had anyone write and say they had tried it and it didn't work, but I'd like more positive testimony.

the circuit, availability, and operation, remember that I'm an engineer, NOT a doctor. Please don't send me a letter detailing your health problems and asking for advice. That would put me in the position of practicing medicine without a license, and I can't do that! For information on what others have done and their results, get a copy of Wayne

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73 Amateur Radio Today • May 1997 19

# Multi-Band Remotely-Tunable Inverted L Antenna

*Here's a neat 160-40m wire antenna project using flexible parts-placement techniques.*

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**I**n the vast majority of antenna building projects, it's safe to assume that no two identically constructed arrays will exhibit the same electrical and performance parameters. Ground characteristics, proximity of trees, antenna length, contiguous buildings, height above ground, coaxial cable loss, velocity factors, etc., affect the ability of the system to radiate energy with a performance level equal to the criteria listed in the reference source.

When I set out to build, install, and test a base-loaded, remotely-tunable, multi-band inverted "L" for my home QTH, and then duplicate the project for my country location, little did I realize that the two locations had absolutely nothing in common with each other except that space was restricted for antenna erection. Ah! Ignorance is bliss!

I expected to breeze through the installation. For example, in order to raise the vertical portion of the antenna, I'd use the tower in the city and a convenient tree at the country location. The tower would be easy to climb to attach the supports. In the country installation, a slingshot, fishing pole, reel, monofilament line, sinker, pulley, and some nylon rope would make short work of this obstacle.

So, in my naiveté, I started on the city prototype. Duplicate capacitors, coil, motors, and hardware were assembled to address the requirements of both base-loading networks. After constructing the first matching network; wiring the entire assembly into the ground system (including the piping of my backyard well

and the tower itself); and juggling components, the unit did a more than respectable job on 80/40 meters. Tweaking performance while surfing the frequency was as simple as toggling power to the remote motors and tuning for low SWR.

Confident in my skills, off I went to the country, armed with a clone of my successful prototype. I made absolutely certain that all the components were carefully spaced, firmly installed, and well bonded. Solder connections were double-checked for integrity and the circuitry was verified.

Suffice it to say that no manner of effort could get the array to work. Rocks, instead of concrete, and trees, instead of buildings (and who knows what else), all conspired to make for a monumental non-event. When every possible variation and combination of profanity had been expended and a cooler head prevailed, it became evident that obstacles had to be overcome by altering component positions (coil-capacitor relationships) to compensate for what I now knew to be a vastly different set of antenna-matching parameters. Exasperated, I took the unit apart.

That disheartening disassembly experience, however, resulted in the development of the construction techniques in this article. In a nutshell, it's a system of breadboarding using jumper cables, rather than hard wiring. It's easy to change component configurations within a circuit, on a temporary basis, of course, to maximize antenna performance for a particular locale.

Then, and only then, can all the parts be hard-wired into place, for a solid, low-loss, high-performing matching network.

## What's first?

To utilize this strategy successfully, it's vital that you overcome the mindset that the location and hookup of the coil and capacitor components in the matching network are cast in stone! Simply because they were used successfully in one set of circumstances does not guarantee automatic success in another (seemingly similar) situation. Keep in mind that although the number and value of components may be the same, the way they're wired into the system and how they respond to the peculiarities of a particular environment make a world of difference.

**Fig. 1** shows that there are plenty of matching options at your disposal to achieve that elusive 1:1 SWR. With that firmly in mind, a quick hookup technique gives you great flexibility, and minimal timewasting, moving components in and out of a circuit to test the various configurations. The goal is maximum signal radiation coinciding with the lowest standing wave ratio with the least expenditure of effort—the most gain with the least pain!

The answer is not to remove, rebuild and rewire the unit after each unsuccessful attempt to power up the antenna. That strategy becomes a tedious chore, increases your level of frustration, and is no longer even *close* to a remotely

rewarding situation after even only one or two failures. To make life easy, simply bypass the continual disconnecting and moving of hard-wired components by electrically isolating each of the discrete parts used in the circuit (coil, capacitors, tie points, etc.) and prepare jumper leads to complete temporary configurations.

If a particular arrangement does not work, remove the jumpers, refer to a second schematic, and reconnect for another try. If memory serves, programming the old IBM mainframes (circa 1960) was accomplished in the same manner, using a rat's nest of jumpers and clips. There's really nothing new under the sun!

### Gathering the basic parts

It's a good idea to locate a source of supply and to purchase all the parts before planning any further. Reasonably-spaced air-variable capacitors as well as coils are expensive, so check the surplus catalogs, or scout a local hamfest for these items. In my case, I found that my primary loading capacitor with about

1500 pF, borrowed from an old linear, worked well. I also used a moderately-spaced dual-gang variable (150/150 pF) for the second unit. This component can be paralleled for increased capacitance (with jumpers, of course), or left as two independent units for wiring up Fig. 1(i).

It's important that both air variables rotate a full 360 degrees, since they will be driven remotely by the gear motors. As a last resort, the capacitors may have to be purchased from retail outlets; however, home-brew coils constructed from readily available material and tailored to the project's specific needs can save a bundle.

If you decide on remote tuning, pick up one or two gear head 1-rpm reversible motors. To reduce project costs somewhat, the second motor (or both) can be a standard 1-rpm synchronous model. It works just as well, but I found that it wasn't as convenient for quick fine-tuning. Try to find units with identical driving voltage requirements. Suppliers are listed here, but they should be telephoned to verify current inventory.

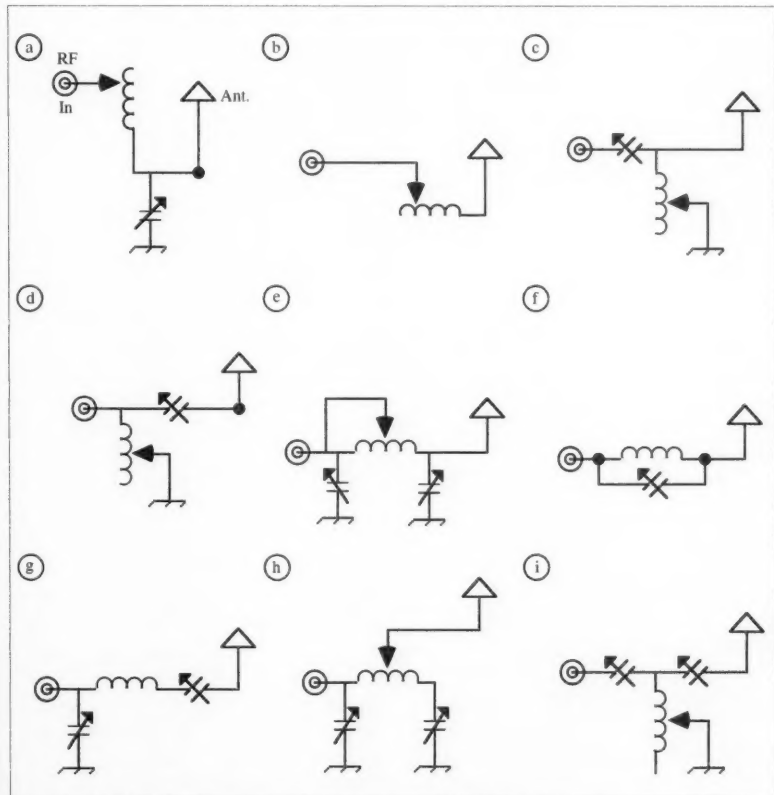


Fig. 1. Possible coil/capacitor combinations for antenna matching.

### Parts List and Suppliers

Part #	Description	Radio Shack #
SW1	SPST	2755651*
SW2	DPDT	275652*
SW3	SPST	2751556*
SW4	SPDT	275709*
NE1	Neon pilot, (110 VAC)	272707*
5-conductor rotator cable		151201*

\* Radio Shack or equivalent

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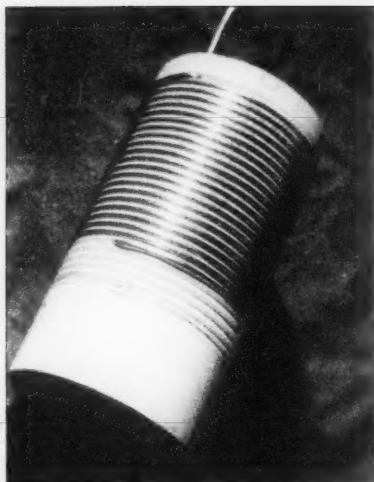
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Don't forget to scout the local hamfests for your needs. You'll need everything at hand to lay out the parts in the most compact manner. Keep in mind that all the components are mounted above ground potential.

Since the matching unit also needed to be protected from weathering, the container selected was nonconductive PVC. I made a quick visit to the housewares department of the local K-Mart™ and ended up with a plastic box originally designed for storing shirts and sweaters. You'll discover an almost endless array of sizes, but it's important that there is adequate depth so the cover can be fitted for weatherproofing without any obstruction.

With the exception of the coil, all the parts were mounted directly to the





**Photo A.** The six-inch length of PVC piping, threaded at 6 tpi, with the coil temporarily wound on the form.

container using junk box hardware. As a precaution, the coil was further isolated from the other components by using short porcelain standoffs. All that remained was to construct (or purchase) a hefty wide-diameter coil that would provide about 22–28 mH.

#### Home-brewing the coil

If you want to experience sticker shock, take a look at the prices for air-wound coils with 3 to 3-1/2" specs. I decided to wind my own using a section of 3" PVC tubing (3-1/2" OD) 6" long and 22–24 turns of #10 AWG solid copper wire at 6 tpi. Look for discarded PVC cutoffs at a new home construction site

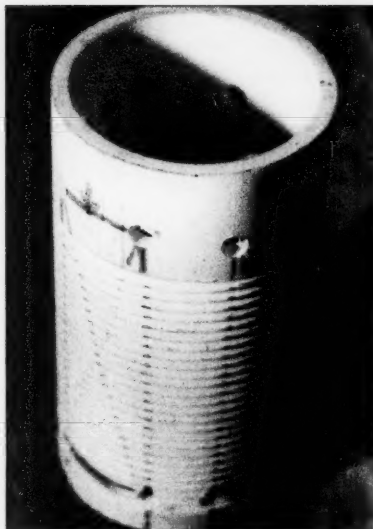
(with permission, of course) or purchase a 3-foot length at a home improvement center. It's cheap enough and there will be many other occasions when there will be a need to wind coils.

You'll need approximately 25 feet of solid bare wire (available off the shelf from an electrical supply house or other source). If you experience any difficulty in locating this type of material, electrician's household AC wire with the protective covering is OK (#12 AWG wire can be substituted with only a slight reduction in performance). Suppliers will cut it to length off a roll, but make certain that it is not kinked in the process.

#### **"Don't be afraid to tweak your signal with the rocker switch."**

Removing the covering is tedious, so it's vital to have a wire stripper with a fixed calibration for 10-gauge wire. Clamp one end of the wire in a vise or loop it around a fencepost and stretch it taut. Remove repeated 6-inch lengths of plastic insulation material by walking the covering down the length of wire. Try not to nick the wire, because that creates an obstacle to the smooth removal of the covering as you move each length down the wire. It may help if you keep the bare wire lubricated with concentrated dishwashing liquid.

Although not essential for winding accurately-spaced coils, it helps if you can have the PVC tubing threaded or at least



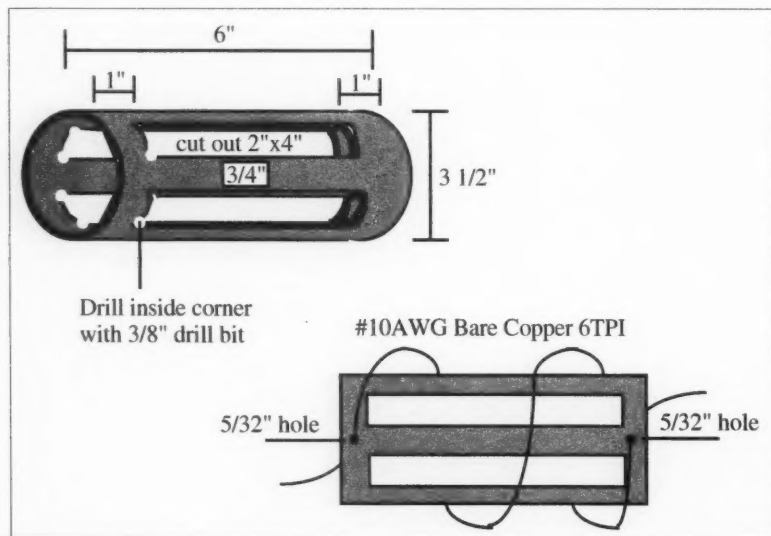
**Photo B.** Remove the coil and measure the 4 sections. Cut away the four 2" x 4" sections (marked with the X).

scored at 6 tpi. If you're not fortunate enough to have (or have a friend with) a lathe, visit your local machine shop. It makes for foolproof winding, but again, threading or scoring is not essential for this project.

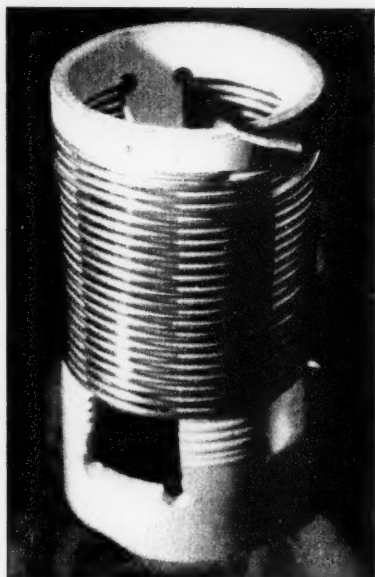
Assuming you're unable to have the threading done, close-wind the full length of wire on the form, keeping the wire taut (**Photo A**). Do exactly the same thing for the lathe-prepared coil form, except follow the threading. In either case, remove the coil of wire from the form after winding. You'll find that your newly-wound coil resembles a Slinky™, and it will be OK to reminisce about your childhood (but only briefly). Force yourself not to try it out on the staircase, since it doesn't have quite the same characteristics as the original.

Using a tape rule, measure around the perimeter of the PVC pipe and divide the circumference equally into fourths (approximately 2-3/4" intervals) (**Fig. 2**). Using a try square, draw a pencil line down the length of the PVC, perpendicular to the face of the pipe at each of the four points. Draw two parallel lines one inch on each side of the reference line, stopping one inch from each end of the PVC. Form four rectangles (each measuring 2" x 4") and drill a 3/8" starter hole at each of the eight inside corners (**Photo B**), and use a saber saw to make the cutouts as shown.

Before rewinding the wire onto what has now become an air-wound form,



**Fig 2.** Coil form details.

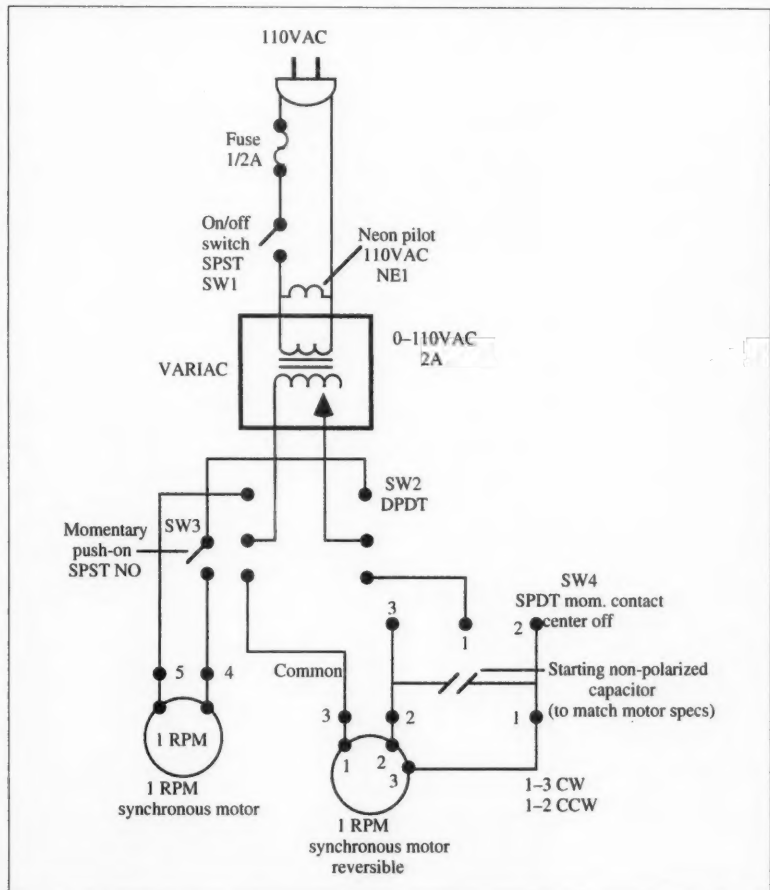


**Photo C.** Rewind the coil on the form. Note that the ends of the coil are protruding from the top and the side and will be used for hookup points.

drill two 5/32" holes in alignment along one of the support ramps one inch from each end of the PVC. If your measuring and cutting is reasonably accurate, the remaining four sections of wire-supporting PVC should each measure approximately 3/4" x 4" long.

Start the rewinding process by placing an end of the coil into one of the small holes (**Photo C**). Rewind your Slinky, keeping a moderate tension on the form. It might help if you can borrow another pair of hands, since 10-gauge wire often has a mind of its own. At the 24th turn, thread the end of the coil into the remaining hole, give it a twist with a pair of pliers, and you're ready to move on.

Leave a sufficiently long pigtail on each coil end for hookup points. If the form is not threaded, adjust the spacing evenly along its length. If you're concerned about minor changes in the value of inductance, run a couple of beads of silicone caulk or hot glue along the coil's length to ensure rigidity.



**Fig. 3.** Straightforward power supply wiring schematic to power the two remote synchronous motors.

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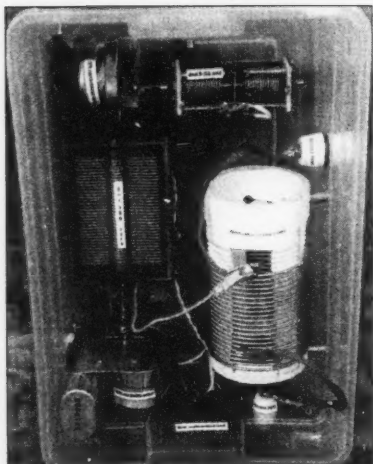
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**Photo D.** Located below the coil is the antenna input feedthrough insulator. At the upper right is the antenna output feedthrough.

### The home stretch!

Mount each of the components and drive motors directly onto the enclosure. Don't forget the standoff insulators for

the coil. Use my model (**Photo D**) as a placement guide or feel free to configure your own. Mount feedthrough insulators on the side for the antenna output and one on the bottom for input. A heavy brass nut, bolt, washer, and solder lug provide for a solid ground attachment point.

I used a five-position barrier strip to wire the remote tuning motors, via a five-strand rotator cable, to the 110 VAC variac supply. The Powerstat driven voltage supply was used only as a convenience to drive gear motors of any voltage. Often, it's pot luck when you're looking for appropriately rated miniature AC motors, and only odd voltages are available. Incidentally, it's usually cheaper to buy 20 VAC units instead of 110 VAC models, for obvious reasons. Remember, if you want to stay flexible use a variac with this aspect of construction. However, discrete isolation transformers, with output ratings to accommodate odd motor voltages, can be substituted and will work just as well.

Keep in mind that the use of a variable-voltage power supply option will not affect the shaft output speed if you deviate from the synchronous motor's voltage rating. They're specifically designed that way in order to maintain rated output even with 10-20% power-line fluctuations. Check **Fig. 3** for the straightforward wiring of this power supply component.

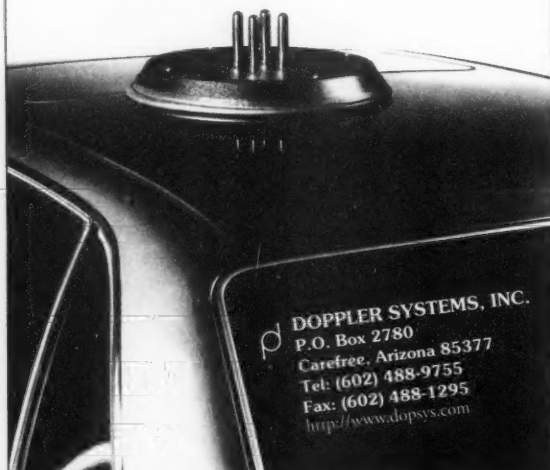
I used a scrap piece of 4-inch PVC and two matching caps to form the enclosure (**Photo E**), but any type of case will work just fine. The 2-amp variac was mounted inside one of the PVC caps along with an on/off switch and a power indicator light. Five binding posts were placed near the bottom of the unit. In close proximity, mount a DPDT and SPST (normally open) momentary-contact switch. These toggle voltage to the two motors and activate the 1-rpm synchronous motor, respectively. The momentary-contact center-off SPDT switch drives the reversible motor and will change its rotation

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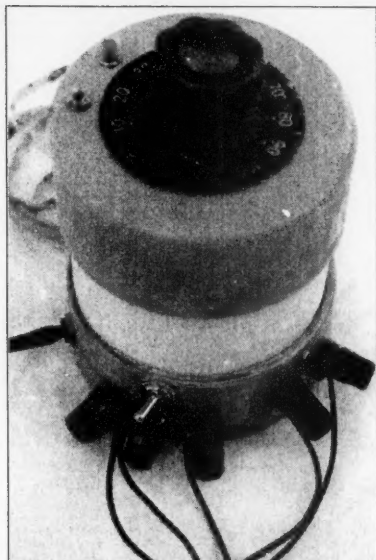
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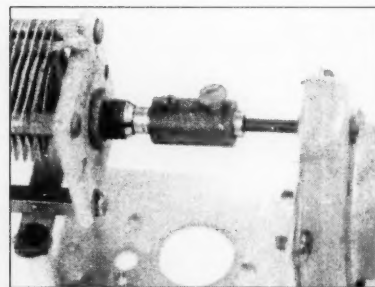


**Photo E.** Two PVC caps and a short length of four-inch plastic pipe provide an enclosure for the variac AC power supply.

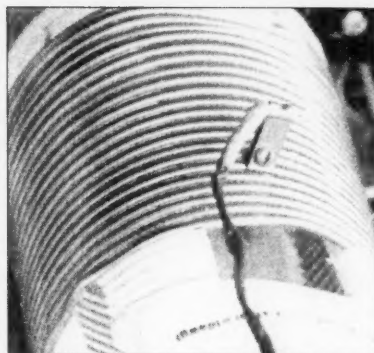
depending on the switch position. This is a great (optional) feature since it allows you to rock the capacitor to tweak the output (**Photo F**). Use self-tapping screws to secure both the top and bottom cap to the length of piping.

Solder eight- to 10-inch tinned lengths of 58U copper braiding or flexible wire to the input and output of the coil and capacitors, and attach alligator clips at each of the ends. Prepare an additional supply of jumper cables with double-ended clips (**Photo G**). Mount the matching network enclosure near the base of the antenna. Wire the coax to the input and ground, and the output to the longest length of antenna you can muster.

Use a strain insulator between the antenna and the network's input to



**Photo F.** Coupling the capacitor to the synchronous motor can pose a minor problem if the shafts have different diameters.



**Photo G.** The alligator-type jaw of a clip I found at a hamfest is opened by loosening the set screw and then pressed onto the coil.

eliminate the possibility of damage from the wind. Before flat-topping the array, it's always a good idea to get the vertical radiating portion up as high as possible for the best propagation characteristics. Although random lengths of wire will usually work okay, it is preferable to measure out multiples of 65' to ease loading.

Using the jumpers, wire up the first circuit following one of the schematics. I've found that the MFJ-249 SWR analyzer quickly indicates if you're on the right track and is infinitely more convenient than using your transmitter and SWR bridge. It's great to watch the SWR dip as the capacitor values interact in the matching network when altered remotely from the convenience of the shack.

If you're not happy with the results, move on to the second wiring option and hit your switches. Coil taps may have to be altered, but it won't be long before the exact combination of components and values will be radiating your signal into the air where it belongs. When the best combination has been determined, and maximum signal radiation has been achieved, replace the jumpers with hard wiring and install the weather-protective cover.

Once you're set up on any frequency, don't hesitate to make excursions over the entire band and tweak your signal by using the rocker switch to dip the SWR meter. If you're fortunate, you'll find that you can tune 40 meters with a minimum of capacitance and move to 75/80 meters on the same coil tap by adding more capacitance. Try it—you'll like it!

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## Where's the Fun?

The 10 meter test had started, and I expected the band to open about the time I arrived at the motel. Rig and gel cell were in the trunk. Maxi-J was right beside, rolled up inside the launcher pail. Room with a view. Maxi takes off from the balcony sloping down to a tree. His tail slips under the door. And I'm 59 in Japan.

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# Ham Vacation

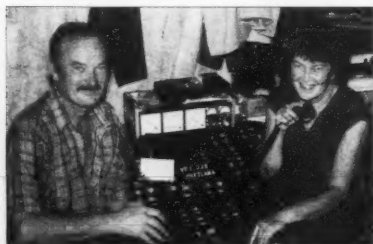
*A six-week journey through Yugoslavia.*

George Pataki WB2AQC  
84-47 Kendrick Place  
Jamaica NY 11432

In the summer of 1996, I visited many amateurs in Hungary and Yugoslavia. I was able to see many radio clubs and personal stations, where I noticed the large number of YLs and XYLs, as well as youngsters, participating in the hobby.

Family ties in eastern Europe may be stronger than those in the West. This can be attributed to tradition and education, and perhaps to the fact that there are fewer attractions available outside the family than there are in more affluent societies.

In Yugoslavia, a large part of ham activity is in radio clubs. To operate a radio station, just like in other countries, you have to pass an examination. There are two kinds of amateurs: those who are licensed to operate radio stations but don't have personal calls, and those who have callsigns. To get a personal license and a callsign you have to be at least 18 years old. Therefore, even well-trained youngsters are limited to working through radio clubs, using the club's call, under the supervision of a fully licensed amateur. Even adults in the first stage of their ham activity start by being an operator at a club.



**Photo A.** Joca YU1JS and his wife Svetlana YT1JJS in Ripanj.

Every club has a name. The most favorite namesakes are Nikola Tesla and Mihailo Pupin, two famous native sons who made important contributions to electrical science. If these two names are already taken in a locale, then a new club will go for a geographical one. Many hams and radio clubs have huge towers and antennas, and there don't seem to be any restrictions or zoning laws whatsoever.

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***"The economic situation in the country has deteriorated because of the war... The sales tax, for example, is 26%..."***

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Every amateur has to be a member of a club and every club has a fully equipped radio station. Those who have personal callsigns and can afford to buy their own gear and set up a station at home often involve members of their immediate family in this hobby. I saw several husband/wife and parent/children teams. In most cases the husband, or father, was the more advanced in the family, but there were also instances where husband and wife had licenses and achievements at the same level.

The Radio Amateur Association of Yugoslavia, a member of the IARU, is very well organized. There are many kinds of activities, both in the numerous clubs and by individual hams. Years ago, the YU hams had the best equipment in eastern Europe because they had more freedom to travel. Thousands of Yugoslavs worked in western countries,

especially in West Germany, and they could afford (and had the chance to buy) all sorts of modern appliances.

In recent years, however, the economic situation of the country has deteriorated because of the war in Bosnia and the blockade that followed. The sales tax, for example, is 26%. These days, there are very few dealerships selling radio equipment. Most of the gear, made in Japan, is brought in by occasional travelers and is very expensive.

In Yugoslavia, there are six categories of license, A being the highest and F, the lowest. The maximum allowed power is 1.5 kW; on the WARC band and on six meters, only 300 watts is permitted. The test for the A license requires code operation at 20 wpm, and the A hams have allband privileges. The no-code E licensees can use a maximum of 30 W on two meters and 70 cm.

I used Belgrade as headquarters on my trip. At the YU1IOP radio club there, among the many hams I was fortunate enough to meet were two couples: Lidia YT1LID and her husband Dragan YT1SDV; and Mira YT1MIR and her spouse Uros YU1EG.



**Photo B.** Toma YU1AB and his wife Sladica YU1SL in Valjevo.



**Photo C.** Rade YT1FRR and his wife Cica YZ1DTS operate on the 2m band in Kragujevac.

While in Belgrade, I went to see Elmax, a repair shop specializing in amateur radio equipment. They have gear made by Kenwood, Yaesu, Icom—even some vintage Collins transceivers. They also build new equipment on special order: I saw a very nice 1 kW amplifier. The shop's owner is Max Maksimovic YU1MM; his wife is Rose YT1NZN. Their shop is a meeting place for amateurs with or without any business to conduct.

Belgrade is also the home of Buda YT1RBB, his wife Jela YT1EYL, and their daughter Jasmina YT1RYL. All three have VHF licenses and operate only on 2m with a homemade 25-watt amplifier. They live on the ground floor of a 16-story building, where the coax cable from their shack to the 12-element homemade yagi on the roof is 247 feet long.

In the village of Ripanj, where we went next, there is a couple living on a small farm: Joca YU1JS and his wife Svetlana YT1JS (Photo A). Their daughter Dragana, who died in a car accident, was an operator at the YU1AIE club station in nearby Lapovo.

In Valjevo, about 62 miles southwest of Belgrade, we met Toma YU1AB, ex-YU1DZ, and his wife Sladica YU1SL (Photo B). It is hard to believe that



**Photo D.** Radmila YU1GR and her husband Ivan YU1HA, in Kragujevac.

Toma has only a multiband dipole, and a 17-element yagi for 2m, because he is on the DXCC Honor Roll No.1; CQ DX Honor Roll; WPX Honor Roll; and has the 5BDXCC, 5BWAZ, etc. The reason is that in Lajkovac, in his parents' house, Toma has a big station feeding 1 kW to a 4-element tribander on the top of his 56-foot-high tower.

Toma is the president of YU1GTU, contest call YT1L, the radio club in Lajkovac. They use 1 kW and have 338 countries confirmed. We also met Slavko 4N1RS, Dusan YT1DL, Voja YT1DOS and his son Milan. On top of the club's 60-foot tower there is a 3-element yagi for 10-15-20m, an 11-element yagi for 2m, and a couple of wire dipoles for 15 and 80.

One morning, Rade YT1FRR, his wife Cica YZ1DTS (Photo C), and Milan YZ1PWO picked me up at my hotel. We drove to Kragujevac, population 180,000, about 65 miles south of Belgrade. There we visited Ivan YU1HA, president of the local radio club YU1EFG. Ivan, a retired sergeant, was a partisan during World War II. His wife Radmila YU1GR was licensed in 1968. They have a good station, with a ground plane for 10-15-20 meters and a wire dipole for 40 and 80. Both work only on CW and have impressive records. Ivan is a contester, with 700,000 QSOs, 361 countries confirmed, and 1,384 awards; Radmila has 289 countries for her DXCC (Photo D).

I also met Mile YU1QQ and his son Nikola while they were operating from the YU1EFG club station (Photo E), as well as Ratko YU1NR and his XYL at their home in Kragujevac (Photo F).

Ivan and Radmila have a second house in Knic, about 13 miles from Kragujevac, with a homemade 70-foot tower, a 3-element cubical quad for 20m, and a 4-element quad for 10 and 15. A second tower, 33 feet high, has a 5-element yagi for 6m and a 21-element yagi for 2m. They also have a 2-element wire beam for 40m directed to the US, and a horizontally-polarized Delta loop for 10 to 80. They use 1.2 kW and have lots of homemade equipment. Now maybe you understand where those 700,000 QSOs have come from?

In Jagodina, I found Miodrag YZ1MCM, who works in the local electrical cable factory, his wife Ana YT1ECA, and their daughters Monica YT1ECM and Isidora



**Photo E.** Mile YU1QQ and his son Nikola operating at the YU1EFG club station in Kragujevac.

YT1FCI (Photo G). All have VHF/UHF licenses and operate on the 2m band, which in Yugoslavia extends from 144 to 146 MHz.

Rade 4N1RK drove Miodrag YZ1MCM, Zoran 4N1EV, and me to Cuprija, where we saw Mile YU1MI. A salesman of electrical and electronic equipment, Mile uses a computer for packet, has a 100-watt transceiver, and is building an amplifier. On his 50-foot homemade tower, he has a 3-element yagi for 10-15-20m; two 11-element yagis, one vertically-, the other one horizontally-polarized; and 3 dipoles for 80, 40 and 20m. Mile has an A (Extra) class license and a nice QSL. His daughter Dragana YZ1NZC has a VHF/UHF license for 2 meters and 70 cm.

In Krusevac, population 42,000, I found the YU1ADO radio club. Its secretary is Lila YZ1SL, who received her B license in 1995. She works at the post office. The club has 80 members. They use a TS-430S with an 800-watt Yaesu FL-2277B amplifier. The antennas are: a Delta loop for 80m; a dipole and an inverted V for 40m; and a ground plane for 20. The club has about 200 countries toward their DXCC.

I also saw Lila's home station, YZ1SL. Her family are refugees from



**Photo F.** Ratko YU1NR and his XYL (no personal call) in Kragujevac.



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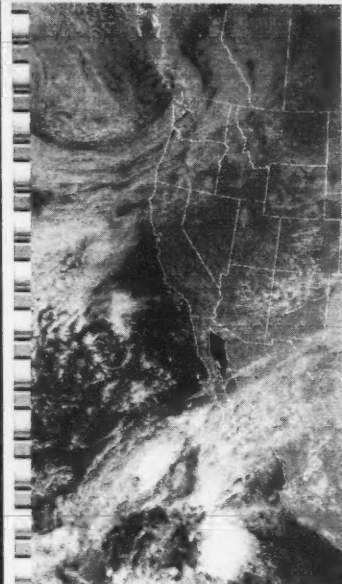
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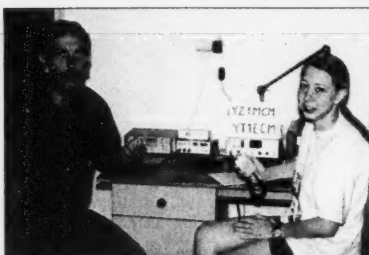


Photo G. Miodrag YZ1MCM and daughter Monica YT1ECM in Jagodina.

Bosnia, where she was X5SL. Her husband Saki works in a metallurgical factory—he used the X5SV call, with the controversial X5 prefix, in Serbia. Their son Andrej is in high school, and their daughter Aleksandra is in college studying economics; both have class C operating licenses without personal calls. They work on SSB and CW with a small transceiver and a dipole for 80m (**Photo H**). [Note: The X5 prefix used by the hams on the Serbian side of the divided Bosnia-Herzegovina is unofficial. It will be used until the status of this disputed land is clarified and an official prefix is assigned.]

I finally got to Kraljevo, where the first hams I visited were Rate YT1EKR and his wife Goca YT1RGA (**Photo I**). Both have been enthusiastic CB operators for many years. Now they have no-code E licenses without personal callsigns, and with 30 watts and a 7-element vertically-polarized yagi they also operate on 2m.

About 6-7 miles from Kraljevo is the small village of Vitanovac, where one of the greatest stations I have ever seen is located. It belongs to Hrane YT1AD, the



Photo H. Son Andrej (no personal call), mother Lila YZ1SL, and father Saki X5SV in Krusevac.



Photo I. Rate YT1EKR and his wife Goca YT1RGA of Kraljevo.

president of the Radio Amateur Association of Yugoslavia. Hrane is in the import-export business and lives part of the time in Moscow, Russia, where he is RV7AD. Because he was at a ham meeting in Kraljevo, his brother Milovan YT1IM showed the whole setup to me and Simo 4N1SM, who had also come along. The station has a couple of transceivers and linear amplifiers—nothing unusual in the house of a very rich man. Milovan, Simo and I tried to figure out the multitude of towers and antennas. On a 122-footer, there is a 7-element yagi for 10m; a 4-element yagi for 40m; and a 6-element yagi for 10m fixed in the direction of the US. On a 99-foot tower, there are two yagis for 2m, one horizontally-polarized, the other vertically-; and a 6-element yagi for 20m. On another 99-foot tower, there is a 6-element yagi for 15m; a 3-element yagi for 12-17-30m; and a 6-element fixed yagi directed toward the US. Near the house, on a mast, is a 6-element yagi for 6m. All cables are run underground, despite the long distance from the towers to the building. There are also a bunch of wire antennas we could not figure out.

I met many hams on my trip. I'm sure that among them there are many more who have licensed amateurs in their families. I did not always ask them about this. Those who supplied such information were proud and happy that their hobby and interests are shared by the people closest to them. And that's the way it should be.

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# Timewave Technology's DSP-599ZX

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**T**imewave Technology, Inc.'s new DSP-599ZX is an audio digital signal processor (DSP) made to improve communications in many different modes by reducing noise and interference. It uses an A-to-D converter to digitize the incoming audio signal, runs the digitized data through software algorithms to eliminate all but the desired signals, and then outputs the remaining digital data through a D-to-A converter and audio amplifier.

## Why did I want a DSP?

I had read several product reviews on available units and tutorial articles on how they work. After reading about it, and seeing how powerful DSPs are in applications where I work, I decided I could make good use of one in my DXing, CW and future satellite activities.

The first thing I noticed about the 599ZX was the high quality of construction. It is very solid and heavy. Digital encoders are used for two of the three

variable controls. This is nice because they won't get dirty and become intermittent like typical potentiometers. The third knob is the volume control—it is a common potentiometer. The display window is a 2-line by 16-character backlit yellow-green LCD. Additional individual LEDs are green, yellow and red. The unit is compact—approximately 8 x 9 x 2 inches, small enough that I set mine on top of my HF rig, so the controls are close when they need to be adjusted.

All input and output connections are via phono jacks, so you won't need to buy any high-priced or hard-to-find connectors. You can also use the two DIN connectors that provide access to the same signals. The 599ZX has connectors for two radios. Via the front panel you select radio A or radio B and audio output A or B. Having two channels that are selectable from the front panel eliminates having to unplug and plug connectors when switching between radios. The power connector is supplied so you don't have to run out to get one. According to the manual, the unit requires 1 amp at 12 VDC for proper operation, but I measured .65 amps at normal volume levels. They probably specified 1 amp to make sure the voltage doesn't droop when the volume is set to high levels. I powered my 599ZX from my HF rig's power supply since it is rated at over 20

amps and one more amp of current won't even be noticed.

## So how do you operate this little gem?

The manual is very well organized. It has a Quick Start section so you can begin using it immediately, and separate chapters on CW, voice, data and test modes. I highly recommend reading the *entire* manual first so you can determine all that this very powerful unit can do. Be aware, though, that there is a lot to this unit and you won't remember how all the functions work by reading the manual once. The manual I received had occasional quirks—extra words, awkward sentence structure, etc., but this didn't keep me from using any feature. The manual was three-hole-punch pages held together by prong paper fasteners. As I turned the pages, the manual literally fell apart in my hands. I bought a 50-cent three-ring binder with fold-down tabs and a clear front cover (it would have been nice if Timewave had supplied this). Pictures are plentiful, showing which button or control to adjust.

## CW—where the unit really excels

The 599ZX has a spot feature that you use to match the tone of the desired signal to the center of the bandpass filter.



Photo A. Front view



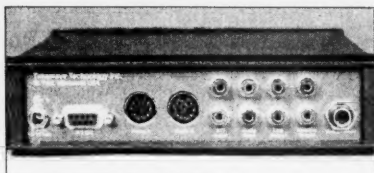


Photo B. Rear view (Photos by Tim Ciesielski.)

You then narrow the filter and all signals outside the passband disappear. Disappear is the correct word. They are not reduced—instead, they actually disappear! You must adjust the level of the spot signal so that it doesn't get covered up by other stronger signals or so that it doesn't mask the signal you are trying to hear. This takes a few button pushes but is not difficult. Other brands of DSPs don't offer this spot feature. Without it you could easily eliminate the signal you are trying to isolate. It is a definite plus! The bandwidth can be adjusted down to 10 Hz. This is too narrow for normal CW operation—about 150 to 200 Hz is as narrow as you can go and not have the individual dots and dashes start merging. Don't confuse the ringing associated with typical audio filters. This filter doesn't ring. The best description I can give is that each dot (and dash) doesn't start instantaneously, but instead turns on and off slowly. At high speed and narrow bandwidth, it is hard to tell when one dot (or dash) stops and the next one starts. The 10 Hz bandwidth is useful for low speed CW in applications such as moonbounce where signals are very weak. If the speed is slow enough you will be able to discern the individual dots and dashes.

Even though you have adjusted the bandwidth as narrow as you can for the speed, sometimes there is still one station too close to the desired signal to be eliminated. For this situation the 599ZX has one more trick up its sleeve—it's called the tunable notch. This is a very deep notch that you can move anywhere to remove a narrow band of frequencies. You simply tune it until the interfering signal disappears. Of course, the notch center frequency is displayed on the front panel along with the bandwidth. For this feature the bandwidth is shown as a number from one to five instead of displaying the notch width in cycles.

The manual didn't say what bandwidth corresponds with what number, except that one is narrow and five is wide. Advancing this number from six to nine results in a dual notch that has two notches that are 180 Hz apart. The manual claims that the dual filter is useful for eliminating interference from data signals. I don't know what data signals they're referring to, but there were two definite deep nulls as I swept the center frequency near the desired signal. The display indicates if you have the single or dual notch filter selected by showing an S or a D.

### Tone reduction

This feature comes in very handy when someone decides to tune up on top of a voice signal. The Tone Reduction should be relabeled Tone Elimination since the tones are gone, not reduced! To check it out, tune in WWV on AM with the tone reduction off. You will hear the usual tone every second. Now turn on the tone reduction. The tones are gone! The same thing happens when you're using SSB and a tuner-upper comes on. All you hear is a very short ping when the interfering carrier comes on, and then no more carrier! Very neat! Just eliminating the tone is neat in itself, but there's always the problem of the receiver's AGC weakening the desired signal if the carrier is stronger than the SSB signal. The 599ZX overcomes this problem by using audio AGC to bring the audio back up to a constant level. It was really neat to be able to hear an S9 signal (before the carrier appeared) below a 10dB over 9 carrier! Imagine that the DX station you're talking to is running S9 at your QTH (not an uncommon level during this sunspot cycle minimum). All of a sudden a carrier comes on at 10 dB over 9. The S-meter isn't following the SSB station's voice because the carrier is stronger than the DX station's voice! You push Tone and the carrier is gone. You push AGC and the DX station's audio comes right back up to where it was before the carrier appeared. Nice, very nice! I have Variable Passband Tuning on my rig. With this control you can adjust the IF passband to reject an interfering signal. Sometimes it helps with an interfering carrier, sometimes it doesn't.



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The tone reduction in the 599ZX always works.

### Noise reduction

The Noise Reduction feature is not the panacea that I had envisioned. If a signal is weak, it definitely helps. Noise reduction is just that: The noise is reduced, but not gone. Most weak signals are made more readable when activating this feature. However, the signal must be just above the noise and not in it. The audio is a little more harsh (not distorted) when using Noise Reduction. However, if the audio is distorted, the noise reduction actually makes the audio worse. My guess is that the software doesn't recognize distorted audio as speech and removes parts of it, causing even more distortion (all the more reason to keep your transmit audio as clean as possible!).

I tried the noise reduction feature on 2-meter FM. Signals that were barely above the noise were made more readable. They too were made a little harsh-sounding by this feature.

I also tried the noise reduction on lightning static crashes. It did help some on SSB, but apparently there is very little you can do to fight those large bursts of energy.

### AM line-noise reduction

This feature is absolutely amazing! I occasionally do some DXing on the AM broadcast band and even though power lines in our neighborhood are buried, I am sometimes plagued by 60 Hz line noise. This noise completely covers weak signals and is at best a minor annoyance on all but the very strongest signals.

To test this feature, I tuned in a weak signal on the AM broadcast band that had so much 60 Hz noise on it that spoken words could not be understood. Activating the AM Line Noise Reduction feature produced a perfectly clean signal. There was no sign of 60 Hz line noise. This feature is different from the Random Noise reduction described above. It can be set to either 50 or 60 Hz (user selectable) and only removes noise pulses at the selected frequency. The manual notes that this

feature won't work on SSB, and it doesn't, but there's no explanation why.

### Data modes

There is not a single mode but many different ones. They include RTTY, AMTOR, PACTOR, G-TOR, HF Packet, CLOVER, SSTV, WEFAX. I did not try any of them so I can't tell how much the 599ZX improves operation—but if operation in the other modes is any indication, the 599ZX will really help in these.

### Test mode

This mode reconfigures the 599ZX into several different pieces of test equipment. They include a sine-wave generator, a two-tone generator, a peak and true RMS voltmeter, and PL (CTCSS) decoder/encoder.

---

***"All you hear is a very short ping when the interfering carrier comes on, and then no more carrier! Very neat!"***

---

The sine-wave generator produced a very clean sine wave on my oscilloscope. The level and frequency are both adjustable and are displayed on the LCD.

The two-tone generator produced the two tones that can be used for transmitter adjustment. The level is adjustable.

A peak and true RMS voltmeter are available simultaneously. The range is limited to 2000 mV (2 volts).

The PL decoder is an interesting feature. I connected the 599ZX to a 2-meter rig and began kerchunking the area repeaters (and yes, I identified with my call!). The unit will display the PL frequency in Hz and the level in millivolts. The 599ZX can be used to determine the PL frequency of a private repeater, providing that you can hear stations on the input or if the repeater transmits its own PL. The 599ZX can also generate PL tones. Since most VHF and UHF rigs now come with PL (some can even detect the PL frequency of the transmitter), the only uses I can see for this feature are (1) your rig's PL has failed; (2) you're using an old rig without PL (admittedly clunky and expensive—but it

would work); or (3) you need PL to access a 10-meter repeater with your HF rig.

These features are interesting but I don't know where or when I would use them. However, they are there if you need them.

While I was shopping for a DSP I found out that one of the other brands offered an audio spectrum analyzer function when coupled to a PC. I would have expected the 599ZX to include this function since it is the most expensive unit available. I would definitely trade the AC voltmeter and tone generator functions for an audio spectrum analyzer. Most people have an audio generator, oscilloscope (to set the level) and frequency counter (to set the frequency), but how many of us have a spectrum analyzer? I have access to one at work, but most hams don't have one, either there or at home. I hope software upgrades will include this option.

### Low-pass/high-pass filter

The filter high-pass and low-pass cutoff frequencies are individually adjustable. They were most effective when the low pass was set to 3000 Hz and the high Pass to 300 Hz. The manual said that they could be used in place of a SSB filter. I adjusted these controls in an attempt to reduce some of the interference from nearby stations when using SSB, but audio DSP is no substitute for a good SSB filter in the receiver's IF. My HF transceiver has IF shift and this does help in many situations.

### DSP in the work environment

I work in an aerospace test laboratory where we do vibration testing, among other things. Vibration testing consists of putting the test item on a shaker (very similar to a speaker but much larger). The shaker is driven by a large amplifier (approximately 50,000 watts) over a frequency range of 5 to 3000 Hz. Vibration sensors are attached to the test item at locations where parts may go into resonance at certain frequencies. These sensors are not frequency sensitive and return signals from the vibration frequency, rattles, fuel or air passing through the test item and any other source of noise.

During testing we sweep the frequency of vibration over the 5 to 3000 Hz range. We plot the outputs of the sensors vs. frequency to see where certain areas or parts go into resonance. Very often the rattles, fuel and air noise completely cover the vibration signal. To filter out all this extraneous noise we use DSP tracking filters. They have a moving narrow bandpass window that tracks or follows the excitation frequency. Without them all we can see is noise—no signal is visible. With them we are able to identify very weak signals buried deep in the noise. At times the signal can be as much as 20 dB below the noise!

### It's worth it

At \$370, the Timewave Technology 599ZX is the most expensive of all DSPs available, but you're getting your money's worth and a lot more. The 599ZX has the fastest processing time, so there is no delay in output when you tune the dial. You listen in near real time (18 ms). The six memories are a definite plus—you can switch modes at the push of a button instead of having to adjust many knobs hoping that you have them all set properly. It is also very nice having all of the values and the mode displayed on a backlit window rather than trying to figure out the settings by looking at the pointer on a knob. The 599ZX has provisions for connections to two radios—a definite plus if you plan to use the DSP with more than one. There is no need to switch connectors—you just push a few buttons to switch radios.

I am very pleased with the DSP-599ZX. In several weeks it has enabled me to make DX contacts that would have been impossible without it. Other contacts that would have been difficult without it were made much more enjoyable. Every feature that I was able to test worked as stated in the manual. There were no operating quirks or compromises. The design and operation of the unit was well thought out in every area. For further information, contact Timewave Technology, Inc., 2401 Pilot Knob Rd., St. Paul MN 55120. Phone (612) 452-5939; FAX (612) 452-4571; E-mail dsp@timewave.com. Their Web site is at <http://www.timewave.com>. Be sure to tell them 73 sent you!

• DIP switch programmable  
• CTCSS encoder  
• All 32 EIA tones from 67.0 - 203.5Hz included  
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# The Atlantic Cable

*Have you ever thought you've had a bad day?*

L. VanProoyen K8KWD  
8330 Myers Lake NE  
Rockford MI 49341

Cyrus W. Field had *lots* of bad days. Thirty-five years old in the 1850s, and already retired from a successful paper manufacturing business, Cyrus was aimlessly drifting through life when he happened into conversation with one F. N. Gisbourne. Gisbourne had earlier been involved in an unsuccessful cable laying project: installation of a cable from Newfoundland to New Brunswick, part of the circuit needed to link Cape Race (Newfoundland) to New York. Linking Newfoundland with New York would speed up late-breaking news to (and from) Europe by a couple of days, Cape Race being the last North American port of call for ships headed to Europe across the Atlantic.

Gisbourne was trying to resurrect his project (the undersea part, under the Strait of Cape Breton) with new money, and Field was a possibility. No one as yet knew how to bridge the Atlantic with a cable. As it happened, their conversation about money drifted to the more frivolous, settling on a discrepancy over the true distance between Newfoundland and Ireland. Cyrus considered the discrepancy trivial, but the conversation got him thinking, "Why not a cable all the way?" Armed with this idea, Cyrus soon launched into a twelve-year series of (mis)adventures that was to ultimately end with laying the first Atlantic Communications Cable.

## Early submarine cable development

By the time Cyrus began organizing his cable-laying plans, considerable development of undersea cables had already been done by the British, driven by a desire to link England with the rest of Europe. They had the best facilities of the time for production of a suitable cable, as well as hard-earned experience and capability instructed through several

failures in laying cable links between Ireland and England, and across the Straits of Dover.

The first successful cable-laying across the English Channel was completed by 1850, but the cable soon failed, suffering from abrasions caused by the Channel's gravel bottom. By 1853, the British had overcome most such problems with the development of a lead-coated, resin-insulated cable, as shown by the success of several operational links between England, Ireland, and the rest of Europe.

---

***"With over a million bucks spent, they finally had the strait successfully bridged by July of 1856. Only one problem—the Morse system wouldn't work!"***

---

Further reinforcing Field's plans was new information about the topography of the Atlantic floor, released by the US Navy. The naval survey revealed that the ocean floor along the proposed cable route was much more regular than previously thought, making the task of cable-laying easier than expected.

## The Newfoundland and London Telegraph Co.

On May 6, 1854, Cyrus Field organized the Newfoundland and London Telegraph Co., Inc., with the aid of his friend, Peter Cooper, and other well-off New York investors. The company initially raised \$1.5 million (and a pledge of support from Newfoundland) for starting their first attempt at laying an Atlantic cable. (At the time, they believed this money would finance the entire project... and that only one attempt would be required.)

Cyrus left almost immediately for England to initiate manufacture of the cable. This project went to mid-1855 when Cyrus, now armed with the wire he needed, turned up to lay the first section of cable.

## Remember the Strait of Cape Breton?

Spanning this 55-mile stretch was probably an excellent introduction to how things were to go: The cable broke within two miles of shore, splices also subsequently broke, an uncooperative ship's captain had his own ideas of the proper route for the cable, and, finally, a storm forced the crew to abandon the project with over forty miles of cable down. Cyrus and company were forced to regroup for another try in 1856. With over a million bucks spent, they finally had the strait successfully bridged by July of 1856. The only problem? The Morse system wouldn't work!

Having started with little knowledge of communication systems just three or so years earlier, Field was rapidly becoming an expert in the subject. He was aware of earlier work in signaling by the Germans and particularly a system developed by the British Professor William Thompson (probably better remembered by his later title, Lord Kelvin). Cyrus adopted Thompson's system for the Strait of Cape Breton link and it worked. It was complicated, based on a sensitive galvanometer detector directing reflected light in a Morse-like code to an operator who in turn translated the reflections into text, but it worked. Cyrus hoped it would also work over a 2,300-mile cable.

The Cape Race to New York link was now essentially complete. That was the good news. The bad news was with only 2,300+ miles to go across the Atlantic, the Newfoundland and London Telegraph Company was bankrupt.

## The Atlantic Telegraph Company of Great Britain

Cyrus had spent a good deal of his own money and a lot of his friends' getting this far, and his search for more "sports" in the US was being hampered by his critics. Undaunted, Field set off for England to gain additional financial support, and by the end of 1856, he had secured British backing of more than \$2 million (a lot of money for the times) and organized the Atlantic Telegraph Company of Great Britain.

Back in business, Cyrus and his original friends (The Newfoundland and London Telegraph bunch) immediately set out to pick up where they had left off. By August, 1857, he pushed off from Ireland, laying cable toward Newfoundland. After four days and 350 miles, the cable snapped in two and half a million dollars went down the drain.

At this point, it was obvious that he needed a new cable-laying method. The scheme these guys came up with, though, was unique. They decided the best way was to use two ships, starting in mid-Atlantic, one headed for Ireland, and the other, Newfoundland, each paying out cable en route. Cyrus got it all going by mid-1858 with the two ships and all (he had to convince his backers this would work).

After several highly embarrassing experiences, both ships returned to Ireland to regroup. This was an occasion probably only Field the undaunted would have been able to handle. He had to convince his backers, and indeed he did. Underway again at the start of August, 1858, the two ships headed toward their destinations. Without major event, each ship reached its destination after six days. The Atlantic cable was in. But was it?

### A hero's welcome turns to rebuke

In the first week of operation the cable worked well, but by the end of the second week of August, 1858, trouble began. In the meantime, celebrations were the order of the day for the "Atlantic Cable Heroes," the type of activities Cyrus Field was adept at promoting. The culmination of this hype was to be the exchange of messages between President Buchanan and Queen Victoria on August 16th, but by the 16th the line was

almost dead. In spite of this, the messages got through (after two days of trying).

While the line continued to work to some degree well into October of 1858, word was spreading about the problem. The ensuing outrage that followed from both sides of the Atlantic resulted in Field's lying low for a few months.

After the dust had settled, Field and his backers decided to blame the problem on "faulty cable manufacture" which led to the premature failure of the cable (the "dust" had included allegations of fraud and the like). No one really knew what actually happened, but one thing they all knew was that they were broke, and new money was hard to get. Weeks ran into months and on into years with Cyrus out beating the bushes, trying to raise more money.

Field went on without success for over five years, both in England and the United States. The Civil War was raging throughout America at the time, and it, on its own, generated some interest in the need for a cable. But even the British at the time were reluctant to spend more money on the deal, having been recently burned by another undersea cable fiasco (in the Red Sea).

### The Anglo-American Company

In 1860, halfway through the project, Cyrus W. Field had been forced into bankruptcy. He had consumed most of his personal fortune and that of his creditors on the venture. There came a time, during the nadir of his financial woes, that he became the object of ridicule and public avoidance. Nonetheless, he had persevered, making countless trips back and forth across the Atlantic to promote his cable project until he finally succeeded.

After seven years, Field was again on speaking terms with his old buddies at the Atlantic Telegraph Company and most of the other investors associated with his Atlantic cable project(s). As the Civil War was drawing to a close, he and his colleagues recruited the use of a passenger ship, the *Great Eastern*, for use in cable-laying for a year. By July of 1865, they were ready for another go at laying an Atlantic cable.

In the usual Cyrus W. Field style, they departed from Ireland after much fanfare. One thing he never learned was to

avoid publicity, but with all the experience this bunch had, they *had* learned to continuously test the cable while en route. They were also using the latest in undersea cable design which, unfortunately for Field, still had several years of maturing to go. As cable defects were detected, they reeled the cable back until each bad section was located; they then repaired the defect, and continued on.

With all going well and about two-thirds of the distance traveled, they somehow lost the cable. Ten days later, they found it... only to lose it again, this time for good—or so it seemed. Cyrus must have personally known the coiner of "Try, try again," because off he went to London again, to reassure his backers that he knew what he was doing—and he did it; again, he organized a new company (the Anglo-American Company); he reloaded the *Great Eastern*; and headed for Newfoundland, although delayed almost a full year.

"Day after day, night after night, her great pistons glided in their channels, and the cable poured over the stern without a hitch. At last they had learned how it was done!" —Harlow, *Old Wires and New Waves*.

On July 27, 1866, the *Great Eastern* entered Trinity Bay, Newfoundland, still in communication with their terminus at Valentia Bay, Ireland. The cable was good. The cable was in!

Upon securing the July 27, 1866, cable, Cyrus turned the *Great Eastern* back to sea to look for his lost 1865 cable. Armed with better grappling equipment than he'd had the previous year, he found the 1865 cable on September 5, 1866, spliced it, and brought it ashore at Trinity Bay on September 8. This second cable worked perfectly, and the world now had *two* Atlantic cables. (Oddly, this stunt did more to restore Field's credibility than the docking of the July 27 cable.)

After losing an estimated \$10 million over the preceding twelve years, Field eventually paid back all of his backers and investors, made money for everyone associated with the venture, and was then able to retire as a great world hero. By 1875, using the technology Cyrus W. Field pioneered, virtually every populated continent of the world was linked via cable.

# TV/VCR Tuner Applications

Part Two of three—you may want to keep Part One, from last month's 73, handy.

Hugh Wells W6WTU  
1411 18th Street  
Manhattan Beach CA 90266-4025

Voltages developed for use with tuners must be regulated and heavily filtered to reduce noise and voltage variations. Noise and voltage variations can cause tuner frequency instability, since tuners are voltage-operated devices. Regulators such as the 7812 and LM317 work well in tuner power supplies.

The mixer and band control circuits operate on +12 volts. A pot attached to the +12 volt bus is used to provide an adjustable voltage of approximately +7 volts which is connected to the AGC terminal. The actual AGC voltage value is unique to the tuner and must be determined experimentally while listening to a signal. In operation, the AGC voltage may be varied with a pot and used as an RF gain control.

Tuner tuning is accomplished by providing a voltage which is variable from 0 to 29 volts. The 29-volt supply may remain fixed, but the voltage applied to the tuning pin of the tuner can be varied with a pot. The most satisfactory tuning resolution is obtained by using a ten-turn pot. The addition of a vernier knob to drive the pot is helpful. Even with vernier adjustment, the tuning can seem a little erratic. To smooth out the tuning action, a 1- $\mu$ F capacitor may be connected from the tuning pin to ground. Although a larger capacitor value may be used, the voltage time constant could thus be made too long, allowing frequency adjustment overshoot should the tuning knob be moved too rapidly.

If the tuner has an AFT terminal, you can utilize the feature for fine tuning. If unused, the terminal must be grounded. To be used for fine tuning, the terminal may be connected to the wiper of a 5k pot. Voltage for the pot should be a low value not exceeding 2-3 volts. One end of the pot can be connected to a positive voltage and the other to ground or to -1 volt.

## Construction

Fig. 1 shows the typical wiring and voltage requirements to support a TV/VCR tuner used as a frequency converter.

Mechanical construction is not critical, allowing a lot of freedom for the builder to choose the mounting of the tuner, pots, switch, etc.

Although the regulators are operating well below their dissipation rating, I suggest that they be mounted against a PC board or onto a small heat sink. The objective is to reduce the tendency for a voltage shift as a function of heat rise.

## Dial calibration

After the converter is operating and the IF established at a specific frequency, a "look-up" table may be constructed to

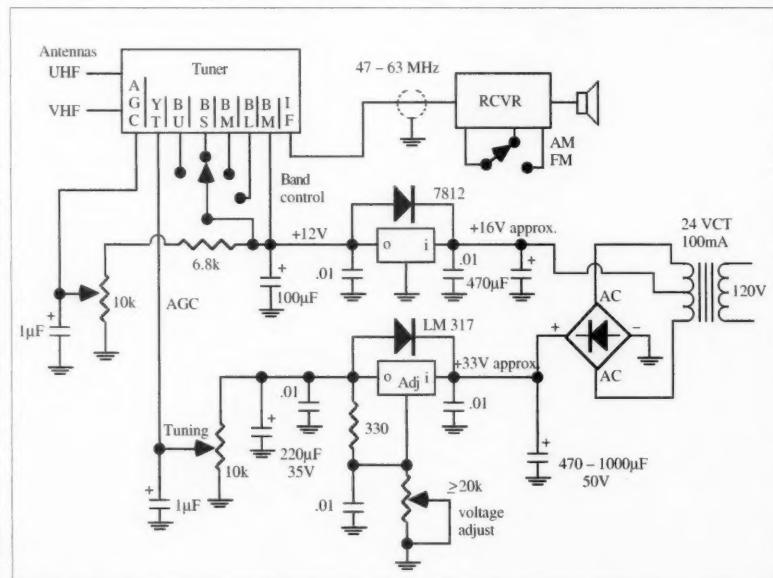


Fig. 1. TV/VCR tuner as a wideband frequency converter.



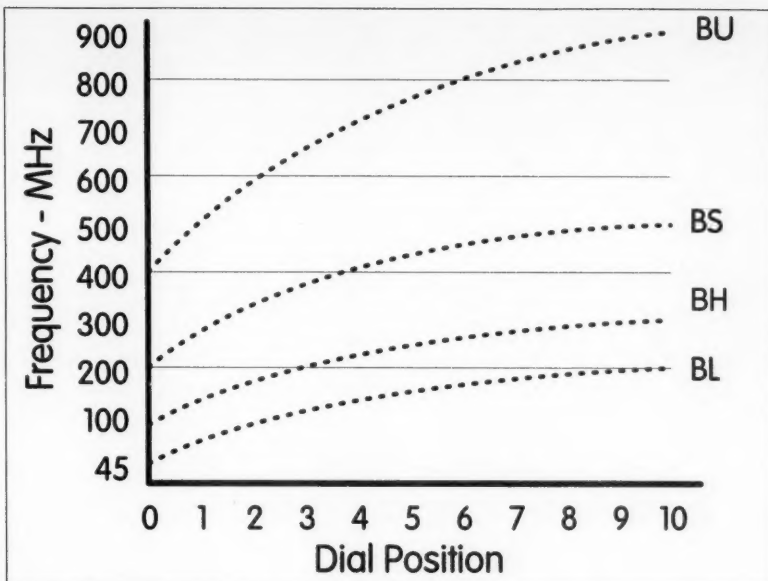


Fig. 2. Dial-to-frequency translation.

translate dial position markings to frequency. Specific frequency settings are then interpolated between known frequency calibration points.

Another method is to construct a calibration curve as shown in Fig. 2. Although the tuning curves are not linear, a straight line may be drawn between known frequency checkpoints. The readability resolution of the chart is set by the spacing between the X and Y coordinates on each axis.

Instead of using dial position markings on one of the chart's axes, you may use the tuning voltage for greater accuracy of frequency repeatability. TV/VCR tuners are quite reliable in their frequency resetability as a function of the tuning voltage. The use of a DVM to measure the tuning voltage to the 1st

and/or 2nd decimal place is desirable.

If a signal generator is not available for determining frequency calibration points, known spot frequencies may be identified and logged. Signals such as cordless phone, FM BC, aircraft, public

**"These tuners have one major drawback in mobile applications."**

service, taxi cabs, ham bands, weather, TV audio channels and cellular phone can provide the necessary frequency references for rough calibration. In most cases it is sufficient to identify the band edges for each service.

Take advantage of tuner availability—build a wideband frequency converter and tune in to the action taking place in the 45-900 MHz spectrum!

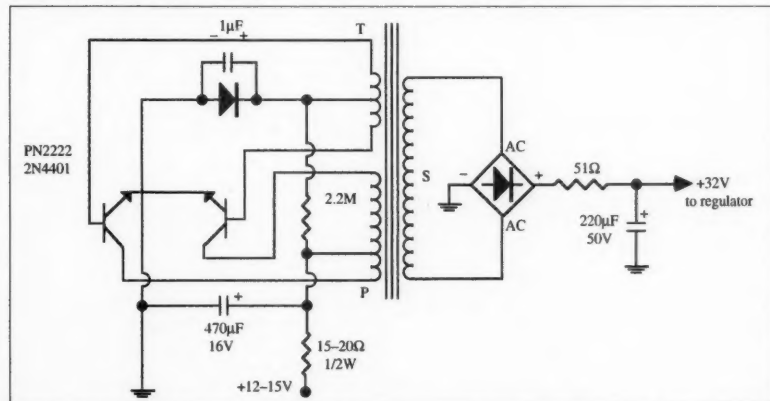
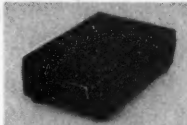


Fig. 3. DC-DC switching converter. All diodes are 1N4148. Operating frequency is approximately 56KHz. Transformer core: powdered iron, OD=0.4 to 0.5in., ID=0.125 to 0.150in. Windings: PRI-15T #26 enamel wound bifilar, SEC-30T #30 enamel, TIC-1T #30 enamel wound bifilar.

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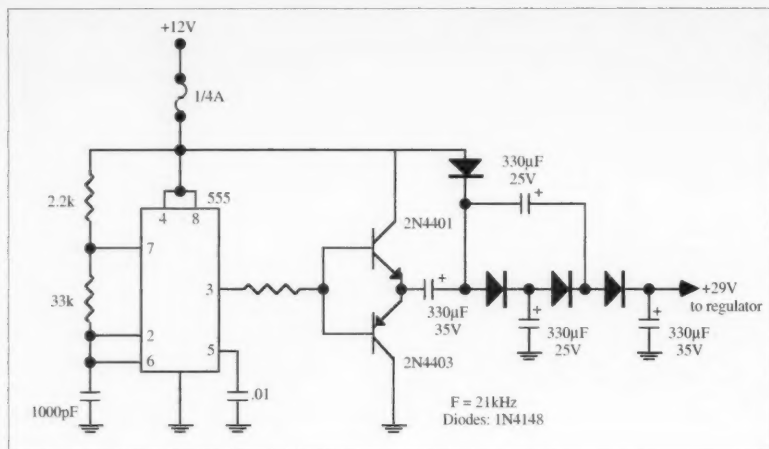


Fig. 4. 555 driving a voltage multiplier.

### Mobile power

Because of their mechanical stability, TV/VCR tuners work very well in mobile applications. However, there is one major drawback that requires attention. TV/VCR tuners are voltage-operated devices and are not tolerant of changing voltage values. Therefore, mobile operation presents a real challenge for the experimenter. With semiconductors available, the challenge can be minimized.

The voltage requirements of a tuner are +12 volts and an ultra stable tuning voltage supply of approximately +30 volts. The +12 volts should be regulated because it is used to power the mixer/osc, band control and AGC circuits. Although most tuners prefer +12 volts, they will function without noticeable degradation down to about +10 volts. An automobile's electrical system is a suitable source and has a voltage value which can vary from

about 12.6 to 14.7 volts depending upon engine speed. A standard 9 V to 12 V regulator could be used to provide stable voltage for tuner use except during the periodic loss in regulator headroom at perhaps a 12.6 V value when the battery terminal voltage falls. A simple zener diode regulator is normally sufficient and solves the problem nicely for the tuner.

The real challenge for mobile operation is the +30 volt requirement for the tuning voltage. There are several ways to generate a high voltage from a 12-volt supply. Two of the ways, a DC-DC converter and a voltage multiplier, are presented here. Perhaps the easiest method of obtaining the desired voltage is to build a DC-DC converter designed around a powdered iron core as shown in Fig. 3. Most any powdered iron core, except ferrite, will work in this application. Switching is accomplished by driving each transistor


alternately into saturation. The core, being powdered iron, does not saturate easily. Therefore, the switching frequency is desirably high (approximately 56 kHz) in order to take advantage of a small core size and to aid in the ripple filtering process.

Another method of obtaining the high voltage is to utilize a voltage multiplier. But for a voltage multiplier to function, it must be driven with AC or a DC chopper circuit. Fig. 4 shows a 555 IC used as a chopper driving a complementary pair of transistors. Working alone, the 555 cannot source enough power, but the transistors can. The transistors are driven from cutoff to saturation by the square wave output of the 555. There is little or no conduction overlap in the transistors, which results in little or no heat generation—therefore, a heat sink is not required.

With the AC voltage component generated by the chopper, the voltage multiplier will increase the output voltage to approximately 29 volts (which is marginal for tuning the high frequency end). It is difficult to obtain a higher voltage from the circuit shown, because only one voltage rail of the multiplier is moving, not two as would be the case with an AC source. Single rail switching limits the function to a maximum voltage multiple of three, minus losses.

Fig. 5 shows an LM317 regulator that is required to regulate the output of the +30 volt source. Adjustment of the regulator is critical in order to obtain the highest possible stable voltage. The correct setting is found during a battery non-charging condition when the source voltage is low. Pot R1 is adjusted to reduce the output voltage just enough to obtain output stability, which will occur when the voltage drop across the regulator rises to about 4 volts. Output voltage stability achieved by this method will be retained as the battery voltage rises/varies while under normal charge.

Because of mobile operation, all parts must be supported mechanically to prevent vibration damage. Heat-sinking, though, is not required since all parts are operating below their dissipation factor.

Next time: Spectrum analyzer, signal source, multifunction signal device. 

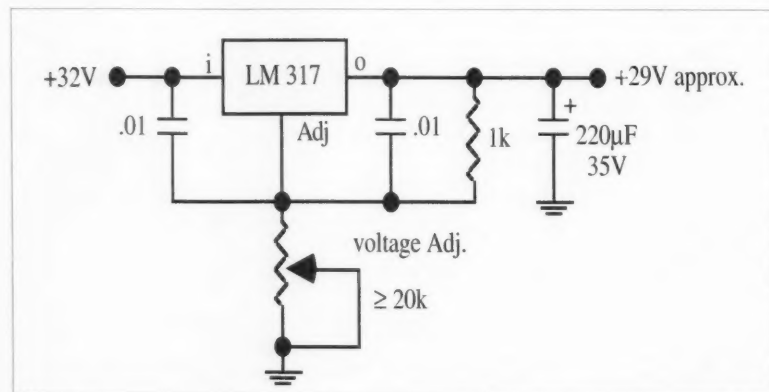


Fig. 5. 29-volt regulator.

## NEVER SAY DIE

Continued from page 7

getting my 60-year membership pin next year.

Okay, now tell me where I'm wrong. Better yet, what do you propose be done and by whom to get our hobby growing like it is in Japan?

### Bad Apples

A reader sent me a tape of K3ZO during a contest. What I heard defied all the accepted ideas of sportsmanship. Yes, this got me to thinking. What can be done about egregiously rude behavior on our bands? Jamming, bad language, and so on? Have you any ideas?

One basic problem is that when a nasty-tempered ham lets loose on the bands there are few, if any, repercussions. It is comforting to know that nasty-tempered people die much sooner than happy people, but they sure can spread a lot of misery while we're waiting for their nastiness to kill them.

Well, I tend to think in terms of solutions, so here's what I propose. How about 73 issuing a "Bad Apple" certificate to hams nominated for this award? The floor is open for nominations, so the next time you are assailed by some dirty rotten SOB on the air, why not nominate this turkey for this award?

Continued on page 49

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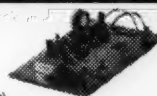
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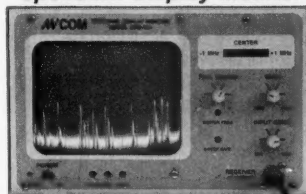
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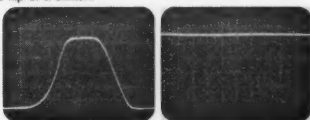
The SDM-42A spectrum display can be used for other applications such as monitoring satellite receiver IF's and demodulating single channel per carrier satellite signals (with optional demodulator circuitry). It can also be used as a general purpose spectrum analyzer covering specific frequency ranges.

#### Broadband Noise Generator



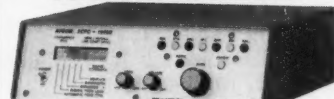
BNG-1000A \$475

The BNG-1000A Broadband Noise Generator adds to the capability of spectrum analyzers such as AVCOM's PSA-65A by allowing them to perform frequency response measurements similar to the use of a tracking generator. The BNG-1000A noise source is useful for sweeping coaxial cables, tuning filters and characterizing amplifiers. Integral RF switching allows the noise reference level to be displayed on the spectrum analyzer, and by a front panel switch, the device under test (DUT) is placed into the network and its response immediately observed. Insertion loss can be measured with the flip of a switch.



Left photo depicts a 70 MHz BP filter displayed on an AVCOM PSA-65A Portable Spectrum Analyzer with the BNG-1000A NOISE PATH in the Through DUT position. The right photo is the same set up with the BNG-1000A Direct To Spectrum Analyzer for quick insertion loss measurement.

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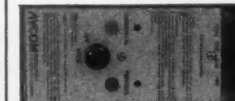
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# Reviewing the Packet Scene: UK 1996

*British Isles hams are ready to meet you!*

Roger J. Cooke GB7LDI  
The Old Nursery  
The Drift, Swardeston  
Norwich, Norfolk, UK  
NR14 8LQ  
G3LDI@GB7LDI.#35.GBR.EU

Obviously quite a few of you have read my article in the February 1993 edition of *Radio Fun*, judging by the response I've had by both packet and snail mail. It is gratifying to know that the UK packet scene is of such interest to our friends in the US. Many thanks for the comments and requests.

Some of the requests asked about packet addressing in the UK and whether a list of BBS was available. Updated lists are sent around the UK network every few months, and the amateur responsible for producing these lists is Brian G8ASO. He puts in a lot of work in compiling the lists and they are very useful. (Ed. note: A copy of the current list may be obtained by sending a #10 SASE to UK Packet List, 73 Amateur Radio Today, 70 Route 202N, Peterborough NH 03458 USA.)

Just to explain the HR addressing: My full address is G3LDI@GB7LDI.#35.GBR.EU. Originally, we used an underscore and a number in place of the #35. Then we adopted a county coding. For example, I am in Norfolk, so that would have been NOR in place of the #35. However, to avoid confusion, and there was some, the # and a number representing each county was adopted. I see that this system is being used in other parts of the world, too. The subject of international HR addressing is an ongoing thorny one and an international standard would really be a great idea.

There have recently been lots of sysop messages debating the suggested change from the two-letter continental field to a four-letter one. This change was originally suggested by Tom Clark W3IWI, in order to avoid some of the anomalies

that exist when forwarding intercontinental mail. However, there has unfortunately been considerable resistance against this change, especially over in Europe. Having been involved with HF forwarding since 1985, I thought the suggestions quite logical and a solution in some cases to the problems encountered in directing certain traffic. Convincing everybody that this is indeed the case is a different matter!

Using the BBS list should enable most to target mail to the county or area they desire in the UK. Obviously, if the full HR address is known, this won't be necessary. Targeting a bulletin, however, can be a real problem. There is a proliferation of @WWW bulletins, most of

which are not relevant, or are out of date, by the time they reach the other side of the world. This problem can be helped with the use of the REDIST server for the FBB BBS. This server, written by Chris McMahon G6FCI, can provide four specific areas of coverage for a bulletin. These are *LocBBS*, *Local*, *Region* and *Nation*. The server has to be configured in the targeted BBS in order to work, but it is gaining popularity worldwide now.

LocBBS is the targeted BBS only. Local is a few BBS surrounding the targeted BBS, Region can be a larger

area still, and Nation is obvious. The only disadvantage of this program is that a list of BBS with it installed, worldwide, is necessary to make full use of it.

## HF forwarding and Satgate operation

With the poor propagation that we are at present suffering, my US link is only on 20 meters. I forward with Joe K1RQG, located in Bucksport, Maine, every day. This is the only Stateside link I have at present, but it is a good one. I have tried tests with West Coast stations, but despite good signals, the QSB on the polar route defeats packet totally!

If, for any reason, the HF route fails, then traffic for NA is sent up to Andrew

### CLIVE DATA BASE COMMAND SUMMARY

AFTER 30/03/91	Lists files installed on/after 30th March 1991
BYE	Quit working the CLIVE station
DOWNLOAD	Sends all selected files to user
HELP	Sends this screen, as does ?
HELP AFTER	Sends help on the AFTER command
HELP HELP	Sends full help file for all commands
QTH	Sends information about the CLIVE station
SCAN XXXX YYYY	Search selected files for words XXXX or YYYY
SELECT 1, 2	Select files using file numbers
SELECT FT290	Select all files with the keyword FT290
STATS	Reports on contents of the database
TOPIC 3	Select topic number 3
TOPIC MODS	Select a topic by keyword
TOPICS	Lists what topics CLIVE has available
UPLOAD	Send msg to disk (Leave a file/msg for SYSOP)
WHAT	Lists files in current topic
WHAT SELECTED	Lists all files currently selected
WHAT NOT	Lists all files not currently selected

GB7LAN in Lancaster for forwarding via his Satgate. This prevents undue delays occurring in NA traffic. I also run a Satgate, the second in the UK, and mail is split between us. This is how the mail is split:

GB7LAN serves the following areas *only*:  
North America—NA NOAM

Central American countries—CEAM  
Caribbean area—CARB

South America—SA SOAM

and parts of Europe via REQSAT server *only*—Iceland, Norway, Finland, Sweden, Denmark, Germany, Netherlands, Belgium, Luxembourg, Austria, Czech Rep., Slovak Rep., Poland, Spain, Portugal, Gibraltar

GB7LDI serves the following areas *only*:

New Zealand, Australia, Pacific Ocean—OC

Africa—AF AFRI by Satgate or HF if there is no Satgate route to the destination country

Asia—AS, ASIA by Satgate or HF if there is no Satgate route to the destination country

Middle East—MDLE by Satgate or HF if there is no Satgate route to the destination country

With the backup of my HF port, mail delays should be minimal, despite problems of propagation, and the mechanical and electronic failures that we all suffer from time to time.

There is another route to the US, also very fast, and that is the Lonny link. This is a New York/London wormhole. The New York end of the link is situated 66 floors up in Rockefeller Plaza in New York City. This link is provided by the NBC TV Employees Amateur Radio Club. The main sysop was Frank WA2NDV, who even named his dog Lonny! However, Frank has had to cease his sysop work and has now handed the torch to Tom NY2S. The Lonny node in Central London gives BBSs such as GB7HSN direct access into the US network. This enables users to have real-time connects with US nodes and even join in on-line conferences across the Atlantic. Access to the Lonny link is at 9k6 bauds. The sysop at the UK end of the link is Derek G1HSN.

## UK linking

A lot of the UK linking is still at 1200 bauds, using two meters and 70 cm.

However, there are several 9k6 links in place on 23 cm now, and experiments are being carried out by some on 64-kbit links. In Norfolk, we are at present setting up a full-duplex linking to the main local repeater by all the BBS, at 19.2 kbaud on 23 cm, to shift all forwarding off two meters and 70 cm, making life easier for the user. This is being achieved by the use of a very nice modem, capable of 38.4 kbaud, designed and built by Matthew Phillips G6WPJ and John Ferguson G8STW.

Licensing of BBS operation in the UK is also different. My GB7LDI packet BBS license is a variation on my full personal call G3LDI. We have to obtain a Notice of Variation (NOV) to operate a BBS. Control of the issuing of these is maintained by the Digital Communications Committee (DCC) which was set up to avoid a proliferation of BBS operation, and also to maintain a negotiating body with the Radio Authority (RA), who control amateur licensing in the UK. Node licensing is controlled in the same way, and site clearance has to be obtained if unattended operation is required. These regulations are at present undergoing a complete review and the NOV is being rewritten. This will streamline the issue of NOVs and avoid the long wait that some have had in the past. In the UK, our two-meter and 70 cm bands are half those in the US, so a tighter control has to be maintained and band-planning is essential. There is a threat to parts of the 70 cm band now from the manufacturers of car alarms and security devices, which are being placed deliberately within the amateur band, along with commercial data links and radar. The sharing of the band is becoming a problem in which the amateur, having no vested financial interest, has little leverage.

By using the BBS listing you will now have a complete and accurate way to route mail to any part of the UK. Even if there is more than one BBS in a particular county, there should be no problem. Send it to any one of them and the correct home-BBS can soon be found. As long as you direct it to the correct county in the first place, this will save the sysop a load of hassle. However, if you have mail for Cornwall and you send it to a BBS in the north of England, the sysop then has to do quite a bit of research to reroute it.

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## CLIVE—a versatile database with a name!

CLIVE is the name given to a very popular database run by Colin G6WHL@GB7KLY.#19.GBR.EU

Currently the mailbox holds over 1300 files and is expanding weekly. You can obtain files from CLIVE with ease. First you want to know what files CLIVE holds which will be of interest to you, so you have to send a CLIVE REQUEST message to the database.

You have to tell CLIVE what TOPIC you are interested in. SELECT what part of that topic you want. You then ask CLIVE to send details on WHAT you have SELECTED. Then say BYE (control Z).

Example: If you want to know all the recipes containing either Chicken or Fish then do the following:

Connect to your local mailbox and type

SP CLIVE@GB7KLY

When "Subject:" comes up, type REQUEST

When "Send your message, end with cntrl Z or /EX" comes up, type the following (on separate lines as shown below)

TOPIC FOOD

SELECT CHICKEN FISH POULTRY

WHAT SELECTED

BYE

^Z

It's that easy—CLIVE will send you a list of all recipes containing either Chicken or Fish.

The reason you SELECT CHICKEN FISH POULTRY is to cover any way that your subject may be stored. (Clive is clever and will sort things out to cover most combinations of your selection.)

The only lines you need to alter for any subject are:

TOPIC (the subject of your choice).

SELECT (the item of interest within the subject).

If you had chosen the TOPIC PACKET and SELECT BSX2 BSX

Clive would have sent you a list (and a few pointers to what you selected) similar to the one at the top of the page.

Now you can select which file you would like to see, so you have to send a message to CLIVE REQUESTing a file. You have to tell CLIVE the TOPIC (subject) from which you want a file downloaded. You then must SELECT the file

No.	Date	Bytes	Description of contents
38	18/08/90	7808	TNC2/BSX2 COMMANDS: A list of commands
39	31/08/90	4505	TNC2/BSX2 COMMANDS: A list of commands
40	31/08/90	4702	TNC2/BSX2 COMMANDS: A list of commands
45	17/09/90	3448	Modifying the BSX2 for STATE MACHINE DCD
48	01/10/90	1506	BSX2 DCD mod. The circuit diagram for file 45
92	03/03/91	3282	Linking DL and BSX TNCs for use as nodes
96	18/03/91	1030	BSX2 TNC mod for open OR closed squelch
CLIVE > BYE			
Thank you for using the database,			
I hope you find the reply useful.			
73, Colin, G6WHL@GB7KLY.#19.GBR.EU			

(or files) and ask CLIVE to DOWNLOAD the file (or files). Then say BYE ^Z.

OK, the TOPIC is PACKET and the file I want is the diagram for the DCD mod; if you look at the list above, that is file 48. So to download the file of your choice do the following:

Connect to your local mailbox and type

SP CLIVE@GB7KLY.#19.GBR.EU

When "Subject:" comes up, type REQUEST

when "Send your message, end with cntrl Z or /EX" comes up, type the following on separate lines as shown below:

TOPIC PACKET

SELECT 48

DOWNLOAD

BYE

^Z

That's it. Clive will send you the file you have chosen. You can send for a selection of files with SELECT 48 92 96; there are currently 23 topics on the database.

### Snippets

Other data modes are gaining in popularity in the UK. SSTV and FAX are used a lot, both on

HF and VHF, using JV FAX, or something similar. Pictures can be made into BMP, GIF, or similar files and passed around on the air. Quite a few are to be found on the satellites.

TCP/IP is gaining in popularity, albeit rather slowly. There seems to be a tendency to shy away from this protocol, mostly because of a lack of information. To help with this situation, Ian Wade G3NRW has written a very good book, called NOSIntro, which explains TCP/IP

No.	Name	Content of Topics
01	BBSs	Bulletin boards & mailboxes on amateur radio
02	PACKET	Packet related files excluding BBSs
03	MODS	Modes to CBs, amateur, and PMR equipment
04	HUMOUR	Articles from Keighley ARS newsletter
05	SOFTWARE	Amateur related programs (sent as ASCII Files)
06	GENERAL	General interest—mainly for VHF users
07	VIRUSES	Description & cure of some common computer viruses
08	PRINTED	Writing, short stories, non-ham technical articles
09	COMPUTERS	Information and articles (other than programs)
10	REQFIL	1000s of files from UK BBSs via reqfil protocol
11	SPACE	Ariane, Galileo, Giotto, Mir, Voyager, Atlantis, etc.
12	ACORN	Acorn computers. BBC, Master, Archimedes, etc.
13	CLUBS	Clubs, societies, user/special interest groups, etc.
14	YAXPAK	News, previews, and reviews of the Yorkshire network
15	SYSOPS	SYSOP conference proposals, decisions, & minutes
16	ATV	Amateur television
17	LIFE	Views of life, the universe, and other things
18	MOBILE	Using/installing transceiving equipment in vehicles
19	LISTS	Lists for use with SCAN command, no download possible
20	MISCOSFT	Miscellaneous software—nontechnical
21	FOOD	A collection of recipes
22	ICOM	Modifications exclusively for ICOM equipment
23	YAESU	Modifications exclusively for Yaesu equipment



and also shows the user how to set up a system. It comes complete with a disk and is a good value for the money in the UK. I don't know if it is available in the US, but it would make a very nice present for any ham.

One of my HF forwarders, who visited me in the late 1980s prior to setting up his own BBS in Moscow, is Leo Labutin UA3CR. I forward every day with Leo, and have a very reliable path to him.

In Norfolk, UK, we have a yearly event on the last Sunday in June, the annual BBQ. It started off purely as a local packet BBQ but has grown over the last 8 years so that now we have over 100 people attending. It sometimes has an international flavour, too. John Bayes VK2SB, from Sydney, and Fred Wyatt VE7PL, from Victoria, have visited, along with their wives. If you are in the area of Swardston, near Norwich, on the last Sunday in June, you will be most welcome.

## High-speed data

Some experimental high-speed packet work is also going on.

Rob G1ZPU is currently working on a 10-Mbit (yes, *megabit*) 10-GHz link between GB7KHW and his system. Although the distance involved is only a couple of miles, it should be possible to prove the technology, leading to the possibility of linking hilltop sites at this unheard-of speed using simple and cheap equipment.

For example, the tx kit will work out at around £40, based on an ATV rx with mods for data. The rx will be nothing more than a cheap Amstrad or similar satellite rx which can be had for around ten pounds at the rallies. An LNB modded for 10 GHz rx will be about £30 (new) or £25 (secondhand). The rx will only need to have a baseband output for the raw video signal. For "video" read "data"! The communication medium is actually 4-wire ethernet. Speed can be anything from 1 Mbit/sec to 10 Mbit/sec. (100 Mbit would require modding the rx circuit even more, and also some serious tx mods, plus it's also pretty band-hungry, as the 10-Mbit link will want 20 MHz for a full duplex link—therefore, a 100-Mbit link will want 200 MHz!) Others have built 64-kbit links at 10 GHz for short point-to-point linking.

That just about brings you up to date with what is going on in the UK... 73 and happy packeting!

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CIRCLE 41 ON READER SERVICE CARD

# Is Your Mixer Circuit Mixing Like It Should?

*It's not bad... it's just misunderstood.*

John Pivnichny N2DCH  
3824 Pembroke Lane  
Vestal NY 13850

Nearly every receiver, transmitter, transceiver, or transverter contains at least one mixer, yet this is one of the least understood circuits—and you will need to know about their operation if you want to build ham equipment. If you ask an old-timer how the mixer works, you'll probably get something about sum and difference frequencies. But what about the signal levels? What should they be? How can you measure them?

## Amplifiers vs. mixers

Amplifier circuits routinely handle multiple signals by amplifying them equally without causing interaction between them. For example, two signals can be combined (added together) with a resistive combiner and then amplified as shown in Fig. 1.

Both signal a and signal b will appear at the output of the amplifier. If they are sine waves of different frequencies, then the two can be separated after amplification with frequency-selective filters. If the amplifier is operating properly, the two signals do not interact with each other. Each is amplified as if the other did not exist and no other signals are generated. In fact, if any other signal or noise occurs, it is frequently caused by improper operation of the amplifier, such as overdriving or flattopping, or by nonlinearities in the amplifier. The spurious signals generated by improper operation are called "distortion" because they distort the waveshape of the two signals.

A mixer circuit's purpose is to combine two signals so they *will* intentionally interact with each other. The two signals are multiplied in a mixer, while they are merely added in the amplifier circuit of Fig. 1. In a mixer, one signal is said to "modulate" the other. When two sine wave signals are multiplied together, additional frequencies are produced, consisting primarily of the sum and difference frequencies. See Fig. 2.

***"Any other noise is probably caused by overdriving, flattopping, or nonlinearities in the amplifier."***

Any circuit which partially or completely multiplies two sine wave signals will generate sum and difference signals of half the amplitude of the product of the amplitudes of the input signals.

All mixer circuits use this fact in one way or another. Practical mixers may do more than just multiply the input signals. They may provide some gain, output filtering, and "balancing."

## The double balanced mixer

The two input signals of a mixer can be prevented from appearing at the output by means of a clever connection which "balances out" their

effect on the outputs. A typical circuit for doing this is shown in Fig. 3. The circuit uses a well-known MC1496 double balanced mixer part. The inputs, labeled carrier and signal, can be applied as differential (push/pull) or single-ended (unbalanced) signals. For example, a push/pull carrier signal can be applied to pins 8 and 10 with .01- $\mu$ F coupling capacitors. An unbalanced carrier signal would be applied to pin 8 with a .01- $\mu$ F coupling capacitor and pin 10 bypassed to ground also with a .01- $\mu$ F capacitor. The output is taken from pins 6 and 12 as shown. For operation from a 12-volt supply, the mixer is biased for 7.23 volts on the carrier inputs, 3.97 volts on the modulating signal inputs and 1.2 mA of current into pin 5.

The bias arrangement of Fig. 4 is used. The outputs can be fed directly from 12 volts through an appropriate push/pull transformer as shown in Fig. 3. Outputs can also be fed with 3.9-k $\Omega$  resistors connected to +12 volts. The output signal is then taken from pin 6 or 12 by coupling with a DC blocking

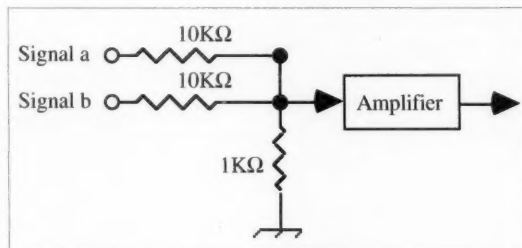


Fig. 1. Resistive signal combiner and amplifier.

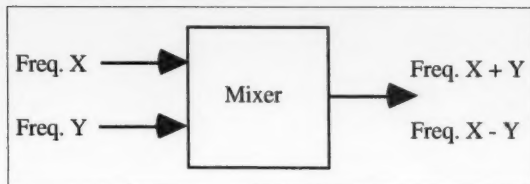


Fig. 2. Mixer diagram.

capacitor. For the frequencies in the HF range (3-30 MHz) a .01- $\mu$ F capacitor is satisfactory.

Balancing of both the carrier input and the modulating signal input occurs because the collectors of transistors c and d are cross-connected to those of transistors a and b. If the circuit is working properly, only the mixing products will appear at the output terminal. Usually some type of filter circuit follows, to

remove either the sum or difference frequency and allow the other one to pass through to subsequent circuits.

#### Test your mixer

How can you tell if this mixer is operating correctly? Suppose this circuit is used to mix a 5-MHz carrier with a 9-MHz modulating signal to produce a 4-MHz output in the 80-meter band.

You can check for a signal at the output with a sensitive wideband RF voltmeter. Some examples of RF voltmeters you can build are given in the references. The one shown in the photograph, known as a dBm meter, is available in kit form [reference 1].

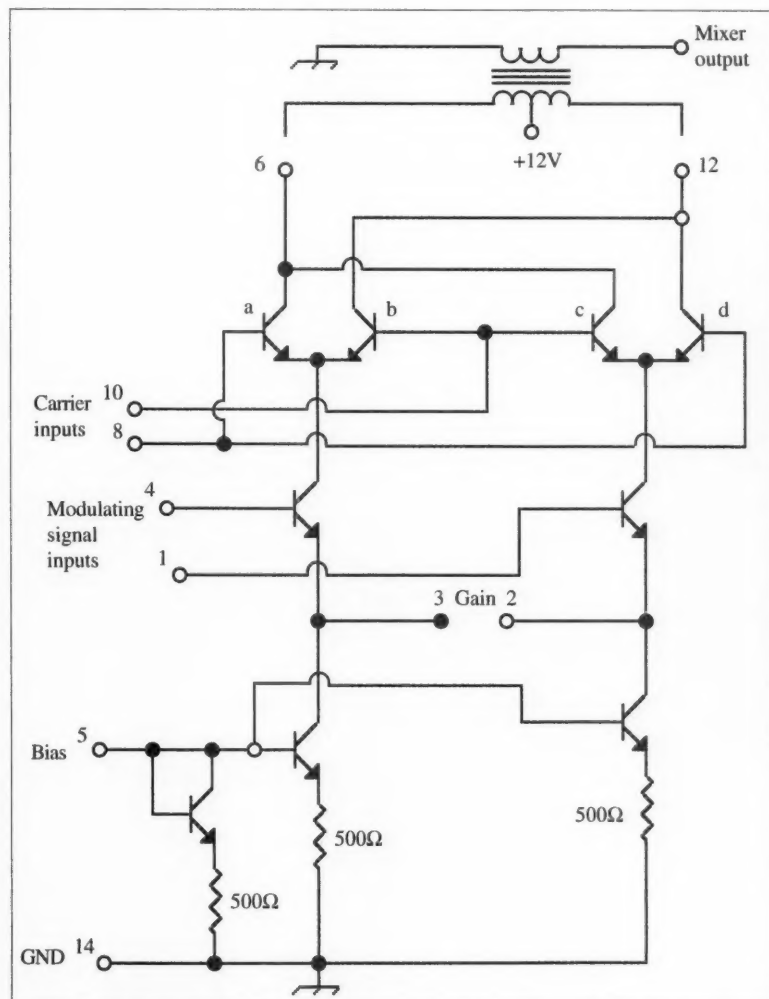


Fig. 3. MC1496 double balanced mixer circuit.

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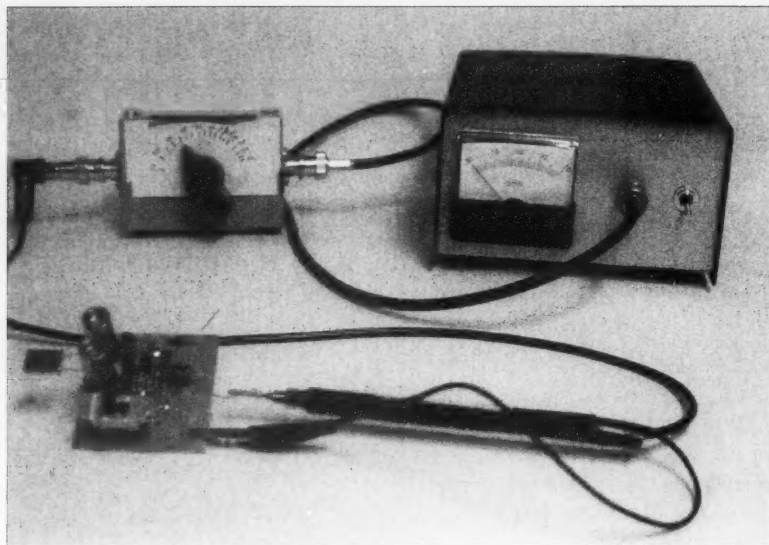


Photo A. Use of tunable filter ahead of RF voltmeter.

The first step is to apply one input signal (the carrier), and remove the other (the modulating signal input). There should be no signal at the output.

Just how weak the signal is at the output depends on how well the mixer circuit is balanced. A typical MC1496 part should have a carrier or modulating signal suppression of 40 dB or more. Temporarily unbalance the mixer by connecting a 10-k $\Omega$  resistor from pin 1 to ground. The output should jump up to

a level two to three times the input level. Now remove the 10k resistor and the output should drop by 40 dB or more. For example, a 100mVrms output with the circuit unbalanced should drop to less than 1 mV when the 10k resistor is removed.

Now try removing the carrier input and applying the modulating signal. Temporarily unbalance the circuit by connecting pin 10 to ground with a 10k resistor. Check for an output

signal and a drop by 40 dB or more as the 10k resistor is removed.

If all is well so far, you have verified that the mixer is truly a double balanced one.

Now what about the sum and difference frequencies? Apply both the carrier and the modulating signals. You should see an output again with a level two to three times the level of the weaker of the two inputs, provided the stronger one is greater than 100 mV rms. But is this the sum or the difference?

Well, at this point it's both. One way to check is to use a tunable filter ahead of your RF voltmeter (Fig. 5). By tuning the filter first to the difference frequency (4 MHz) you can check its presence on the voltmeter. Then by tuning the filter up to the sum frequency (14 MHz) you can check for that, too. As the filter is tuned from 4 to 14 MHz, the level on the voltmeter

---

***"You can check for a signal at the output with a sensitive wideband RF voltmeter."***

---

should be at least 40 dB lower. This includes the fundamentals at 5 and 9 MHz, as well as harmonics (for example, at 10 and 15 MHz). Higher order mixing products such as  $(3 \times 5) - (1 \times 9) = 6$  MHz should also be of low amplitude.

Every mixer circuit should include or be followed by a filter circuit to select either the sum or difference output and reject the other. Typical amateur-quality filters will also provide at least 40 dB rejection of the unwanted mixer output frequency. You can also check this with your voltmeter and tunable filter.

#### Building a simple tunable filter

A basic tunable filter can be constructed using a single tuned circuit. It can consist of a high-Q toroid coil and an air-dielectric variable capacitor (Fig. 6). After winding the toroid core with the main tank coil, two link coils of two to five turns each are added to serve as input and output ports.

Almost any frequency range can be covered by selecting an appropriate core and number of winding turns. As a

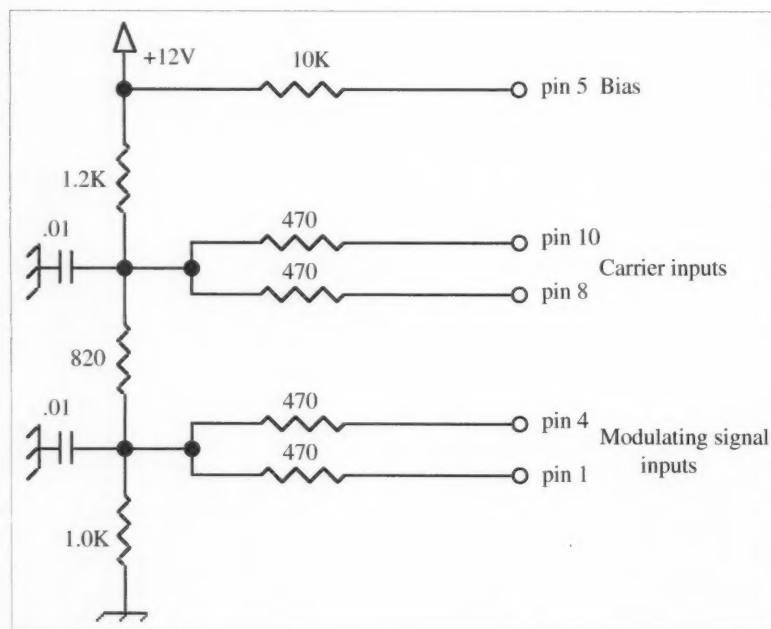


Fig. 4. Bias circuit for 12-volt operation.

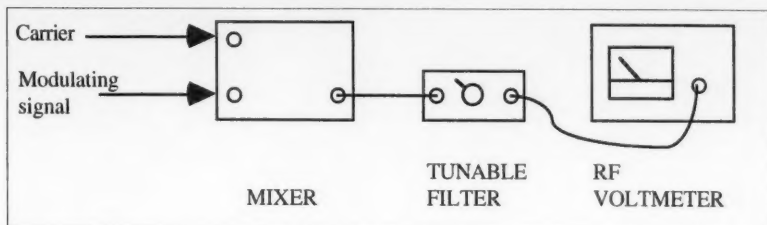


Fig. 5. Using a tunable filter ahead of an RF voltmeter.

convenience, an optional DPDT slide switch can be added to bypass the filter. Mount the whole thing in a small (3" x 2" x 1.5") aluminum box, using BNC connectors for input and output.

### Calibration

You can mark frequency calibrations on the tunable filter dial by using a calibrated signal generator. Feed a known frequency into the filter and connect its output to the RF voltmeter. Tune the filter for maximum output and mark the frequency on the dial. Continue with other known frequency signals until the entire range has been calibrated. A dipper with a two-turn coupling link wound over its coil and connected to the input BNC jack can substitute for the signal generator if necessary.

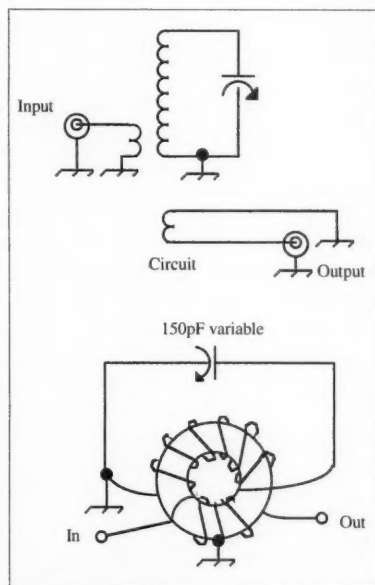


Fig. 6. Basic tunable filter circuit. For 7-20 MHz, use 38 turns #26 wire on T68-10 core. Links, 5 turns #26. For 22-60 MHz, use 10 turns #20 wire on T68-10 core. Links, 2 turns #22.

### Other circuits

In addition to the MC1496, other double balanced mixers are the TL442CN, formerly known as SN76514, and the NE602. Single balanced and unbalanced mixers are also widely used—the only difference is whether or not the carrier or modulating signal is rejected at all by the mixer circuit itself. In a single balanced mixer such as the CA3028, one will be rejected.

With an unbalanced mixer such as the dual-gate 40673, neither input is rejected.

Both will appear at full strength at the output along with the sum and difference signals.

It's up to the filter following the mixer to reject all but the desired sum or difference frequency. As a minimum, at least 40 dB of rejection should be used.

Signal levels at the inputs and output should be checked to ensure that only the desired mixing product is passed on to the following stages in a ham transmitter or receiver.

A sensitive wideband RF voltmeter and outboard tunable filter are essential to perform the checks, but can be easily constructed at low cost. With these on hand a ham can verify or troubleshoot his mixer circuits with confidence.

### References

1. "dBm Meter," John Pivnichny N2DCH, *Electronics Now*, Nov. 1995. A complete kit including case is available from Unicorn Electronics, Valley Plaza Drive, Johnson City NY 13790, (607) 798-0260.
2. "A Sensitive RF Voltmeter," John Pivnichny N2DCH, *Ham Radio*, July 1989.
3. "An RF Voltmeter," Ian Braithwaite G4COL, *Ham Radio*, Nov. 1987.

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# Build a Half-Square DX Antenna

*It's about as simple as they come. And it sure works!*

William Van Tilburg KG8AN  
5198 West Valley Circle  
Portage MI 49002-1932

The half-square antenna is a gain antenna, yet it is one of the easiest, quickest types of antennas to build. This half-square configuration is a DX antenna that on 10m starts picking up signals from about 500 hundred miles out and gets stronger as the signals come from farther away.

The physical size is a full wavelength long, divided into three sections. You have a half-wave section on top, with a quarter wavelength dropped straight down on each end. To figure the length of an antenna you work a simple math problem. The formula is 1,005 divided by the frequency in MHz. This results in an answer for a full wavelength in feet.

## Let's try a sample

First, let's go for the 10m phone section. The middle of the band I want will be 28.4 MHz, where the Novices/Techs can operate. That's  $1,005 \div 28.4$

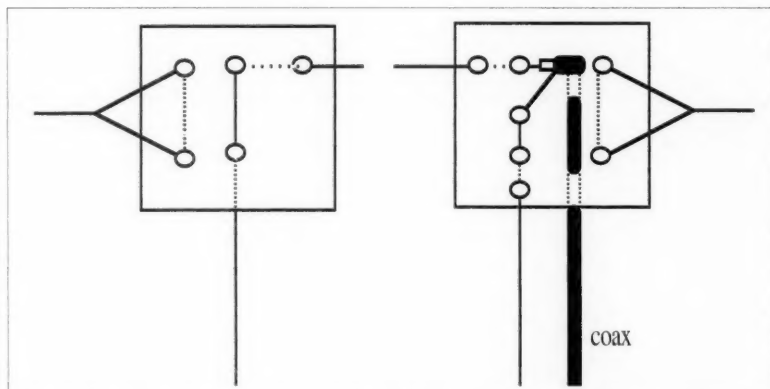


Fig. 2. Feeding the cable and wire through the pre-drilled holes will lock it in place with nothing but the force of friction.

= 35.387 feet of wire to start our antenna. That's 35' 4.5". You will need an extra three inches to allow for a small tie loop at the bottom end of the quarter-wave down legs. Each active quarter-wavelength is going to be 8.846 feet long (8' 10") so double the

wire back to find the center and mark it with a piece of electrical tape. Next, you need to measure 8.846 feet out from our tape marker toward the ends. The down legs will also measure 8.846 feet, plus the one and a half inches for the tie loop.

I have found that a broken white plastic lawn chair can be cut up to make very good antenna insulators. Cut rectangles 1.5 inches by 2.5 inches and drill holes as shown in Figs. 1 and 2. I use a covered wire about #16 gauge, which helps keep down snow static. String the half-wave section in one hole, over and through the second hole, and down through the third hole towards the ground. On the other end, cut the wire at the corner of the top and down leg. Feed the wire across two holes to lock it in place. The other quarter-wave wire is fed up from the vertical through the holes in the plastic to lock it in place as seen in the diagram.

Next, we need to feed the RG-58

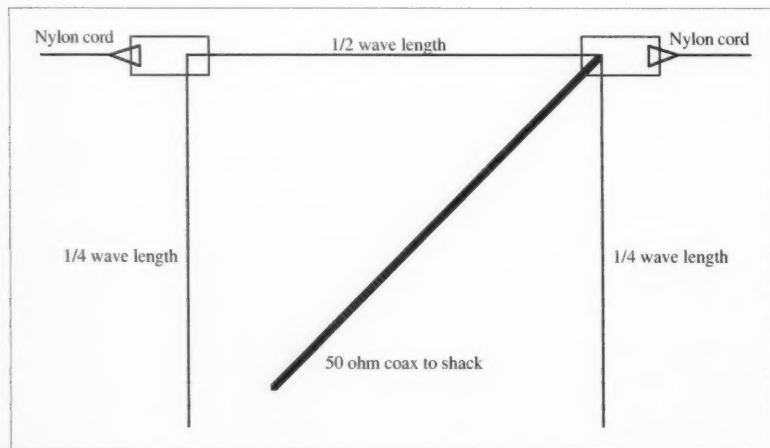


Fig. 1. The whole half-square antenna complete with insulators made from broken lawn chairs.



through two holes to lock it in place; secure the center connector to the top horizontal section and then connect the braid or shield to the down leg as seen in Fig. 2. Next, string the nylon antenna support cord through the end holes to support it between trees, towers, or buildings. The connections of all wires need to be soldered and then taped for weatherproofing.

You need to keep the coax end of your antenna toward the transmitter and at right angles if possible from the top wire. Now pull your antenna up as high off the ground as you can get it.

The height of your antenna off the ground will affect its tuning. Remember, the higher the frequency, the shorter the wire will be. Shorten the wire top section and the legs to make the resonant frequency of the antenna higher. Make your adjustments about 1/2 to 3/4 inches at a time. If you change one leg by 1/2 inch, the top section will have to change by one inch. Make any required adjustments to find the center frequency and it's ready to transmit. Tie a loosely dangling retainer cord to each of the down leg loops to keep it from blowing over the top wire.

The maximum radiation is broadside, so an antenna strung north and south will do best to the east and west. I use this type of antenna at home on 10m, and also during Field Day on 20 from Kalamazoo County, Michigan.

Some of the half-square advantages are about 4 dB gain, a low radiation angle, good noise-canceling characteristics, both vertical and horizontal polarization, and low cost.

I've talked all over the world with this antenna, so be sure to let me (and Wayne) know how it does for you!

*Editor's note: You can greatly simplify the trimming of the antenna if you cut it a little long to start, then find where it resonates (minimum SWR). Now you can make a simple ratio of the antenna length divided by the resonant frequency equaling the desired length divided by the desired frequency. This way, it takes just one trim session and you're in business without all that half inch at a time from each part of the antenna. For example, if you come out 8" too long, just cut 2" from each quarter-wave section—4" from the horizontal section and 2" from each vertical leg.*

## NEVER SAY DIE

Continued from page 39

Describe his offense briefly, and if you have a tape recording so I can join you in your condemnation, that won't hurt.

Perhaps the potential for public exposure and humiliation will help make our hobby more fun for us.

But, while we've an interest in cleaning up our hands by exposing the bad apples, we also should have a medium for rewarding the hams who are helping to make the hobby better. So I'll get busy on both Good Apple and Bad Apple Nomination Certificates. If you know any hams who have contributed positively to the hobby, please don't wait until they're silent keys to nominate them for the Good Apple Certificate.

If you are an artist or cartoonist (or know one), how about a couple of illustrations for the certificates? I need a really disgustingly bad apple drawing, and a good apple.

Now let's see what we can do to reward the good guys and humiliate the bad guys. And if you run into K3ZO on the air, please tell him "Turnips from Wayne."

## The Code Again

A note from reader Boucton in France mentioned that France has decided to end all CW maritime transmissions as being obsolete. It is expected that the other European countries will follow suit. That pretty much leaves the use of Morse to a small group of aging amateurs. How quaint.

In a similar vein there was a mention in *The Old Timer's Bulletin* that radio pioneer Lee DeForest had always had an interest in amateur radio, but could never build up his code speed enough to get a license.

Continued on page 55

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1800N	18.5 x 1.75	118.25	110.50	\$90.63	1800V	18.5 x 1.75	130.50	129.50	\$102.50
1800O	18.5 x 1.75	121.50	112.75	\$93.13	1800W	18.5 x 1.75	133.75	132.00	\$105.00
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1800Q	18.5 x 1.75	128.00	117.25	\$98.13	1800Y	18.5 x 1.75	140.25	137.00	\$110.00
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1800U	18.5 x 1.75	141.00	126.25	\$108.13	1800C	18.5 x 1.75	153.25	147.00	\$120.00
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1800A	18.5 x 1.75	160.50	139.75	\$123.13	1800I	18.5 x 1.75	172.75	162.00	\$135.00
1800B	18.5 x 1.75	163.75	142.00	\$125.63	1800J	18.5 x 1.75	176.00	164.50	\$137.50
1800C	18.5 x 1.75	167.00	144.25	\$128.13	1800K	18.5 x 1.75	179.25	167.00	\$140.00
1800D	18.5 x 1.75	170.25	146.50	\$130.63	1800L	18.5 x 1.75	182.50	169.50	\$142.50
1800E	18.5 x 1.75	173.50	148.75	\$133.13	1800M	18.5 x 1.75	185.75	172.00	\$145.00
1800F	18.5 x 1.75	176.75	151.00	\$135.63	1800N	18.5 x 1.75	189.00	174.50	\$147.50
1800G	18.5 x 1.75	180.00	153.25	\$138.13	1800O	18.5 x 1.75	192.25	177.00	\$150.00
1800H	18.5 x 1.75	183.25	155.50	\$140.63	1800P	18.5 x 1.75	195.50	179.50	\$152.50
1800I	18.5 x 1.75	186.50	157.75	\$143.13	1800Q	18.5 x 1.75	198.75	182.00	\$155.00
1800J	18.5 x 1.75	189.75	160.00	\$145.63	1800R	18.5 x 1.75	202.00	184.50	\$157.50
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1800P	18.5 x 1.75	209.25	173.50	\$160.63	1800X	18.5 x 1.75	221.50	199.50	\$172.50
1800Q	18.5 x 1.75	212.50	175.75	\$163.13	1800Y	18.5 x 1.75	224.75	202.00	\$175.00
1800R	18.5 x 1.75	215.75	178.00	\$165.63	1800Z	18.5 x 1.75	228.00	204.50	\$177.50
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1800W	18.5 x 1.75	232.00	189.25	\$178.13	1800E	18.5 x 1.75	244.25	217.00	\$190.00
1800X	18.5 x 1.75	235.25	191.50	\$180.63	1800F	18.5 x 1.75	247.50	219.50	\$192.50
1800Y	18.5 x 1.75	238.50	193.75	\$183.13	1800G	18.5 x 1.75	250.75	222.00	\$195.00
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1800D	18.5 x 1.75	254.75	205.00	\$195.63	1800L	18.5 x 1.75	267.00	234.50	\$207.50
1800E	18.5 x 1.75	258.00	207.25	\$198.13	1800M	18.5 x 1.75	270.25	237.00	\$210.00
1800F	18.5 x 1.75	261.25	209.50	\$200.63	1800N	18.5 x 1.75	273.50	239.50	\$212.50
1800G	18.5 x 1.75	264.50	211.75	\$203.13	1800O	18.5 x 1.75	276.75	242.00	\$215.00
1800H	18.5 x 1.75	267.75	214.00	\$205.63	1800P	18.5 x 1.75	280.00	244.50	\$217.50
1800I	18.5 x 1.75	271.00	216.25	\$208.13	1800Q	18.5 x 1.75	283.25	247.00	\$220.00
1800J	18.5 x 1.75	274.25	218.50	\$210.63	1800R	18.5 x 1.75	286.50	249.50	\$222.50
1800K	18.5 x 1.75	277.50	220.75	\$213.13	1800S	18.5 x 1.75	289.75	252.00	\$225.00
1800L	18.5 x 1.75	280.75	223.00	\$215.63	1800T	18.5 x 1.75	293.00	254.50	\$227.50
1800M	18.5 x 1.75	284.00	225.25	\$218.13	1800U	18.5 x 1.75	296.25	257.00	\$230.00
1800N	18.5 x 1.75	287.25	227.50	\$220.63	1800V	18.5 x 1.75	299.50	259.50	\$232.50
1800O	18.5 x 1.75	290.50	229.75	\$223.13	1800W	18.5 x 1.75	302.75	262.00	\$235.00
1800P	18.5 x 1.75	293.75	232.00	\$225.63	1800X	18.5 x 1.75	306.00	264.50	\$237.50
1800Q	18.5 x 1.75	297.00	234.25	\$228.13	1800Y	18.5 x 1.75	309.25	267.00	\$240.00
1800R	18.5 x 1.75	300.25	236.50	\$230.63	1800Z	18.5 x 1			

## 73 Review

## The Yaesu FT-1000MP Transceiver

Check out the "Big Rigs."



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This transceiver was introduced by Yaesu to commemorate the father of SSB communications, Yaesu founder JA1MP. The 1000MP combines some of the best of traditional radio construction (Collins filters) with high-end, high-tech, state-of-the-art design.

When I got the radio home I really wanted to try it out—I didn't want to spend time going through the 104-page user manual. Though I have since become good friends with the manual (a very well written and useful tool), I was able to get the 1000 on the air with minimal referral to it. The first thing you notice when you turn on the receiver is the sound. It's a big sound, quiet and full; not that traditional midrangy basic communications-type sound. After spending some time tuning around and enjoying the reception in both the CW and phone sections of the amateur bands, I took it for a cruise into the general coverage waters. If you're a ham who enjoys occasional SWL, here's a treat for you. The manual even turns you on to how to listen to a general coverage station with the main receiver tuned to one sideband and the sub-receiver tuned to the opposite sideband—with the combined output into a stereo set of phones... whew!

### Receiver

The Yaesu 1000MP offers dual VFO reception with separate tuning and display for main and sub-receivers. Both receivers use quad conversion superheterodyne circuitry with three IF stages at 70.455 MHz, 8.215 MHz and 455 kHz in the main receiver and two at 47.21 MHz and 455 kHz in the sub-receiver. The tuning is accomplished through the use of Direct Digital Synthesizers driven by a TCXO master oscillator, resulting in extremely fine tuning with thirteen

selectable tuning steps down to .625 Hz. Receive range is from 100 kHz to 30 MHz, with front panel selection of USB, LSB, CW, AM, FM, RTTY, and PKT.

Frequency selection on both receivers is available by direct tuning; a shuttle jog ring that allows large or small frequency change without cranking; individual amateur band keys with dual access to two user-defined sections and modes of each band from 160 to 10 meters; direct keypad input and memory selection from 99 regular memories; nine program limit memories or five quick memories. Memory can be configured in an almost unlimited variety of scanning options, and both VFOs can be modified in receive and transmit with a clarifier offset.

The QRM-fighting arsenal of the 1000MP includes individually selected cascaded second and third IF crystal filter banks, with 2400 Hz and 500 Hz filters installed and room for additional filters at 2 kHz and 250 Hz; an IF notch filter; IF shift and width controls and EDSP. EDSP stands for Yaesu's Enhanced Digital Signal Processing. This system works at the IF stage of the receiver and provides settings for random-noise reduction, selectable bandpass filtering with adjustable low and high cutoff skirts and automatic heterodyne notch filtering.

### Transmitter

The transmitter in the 1000MP is capable of output on all amateur bands from 160 to 10 meters. The output power is adjustable to 100 watts in all modes except AM where output carrier power is 25 watts max. Output modulation include SSB, AM, FM and AFSK. The transceiver includes a high speed antenna tuner with 39 memories, and a

full-function electronic keyer with multiple emulation types for the CW enthusiast. The EDSP used in the receiver is also capable of transmit audio enhancement utilizing four different voice equalization schemes.

### Display

Yaesu engineers have left nothing to chance in terms of visual indicators for operating parameters. The 1000MP display has a fluorescent, multi-color, easy-to-read digital control panel. The tuning frequencies of both receivers are shown in large orange numerals. In addition, there is an expanded tuning scale that works as either an Rx, Tx clarifier tuning scale, or a tuning indicator for increments of less than 10 Hz. Separate S-meters for each receiver are bargraph digital type with the main receiver meter also incorporating RF power output, final amplifier collector current, SWR, speech compression, ALC, and DC supply voltage or microphone audio input level. If that's not enough metering, there is also a tuning scale that provides a center tuning segment for zero-beating CW stations and twin bars for mark and space tone tuning of digital modes.

Want more display? There are multi-color indicators for everything from HI SWR to external computer control. The Multi-Display window allows for a choice of memory channel frequencies, split offset or CW pitch. As a final touch, the sub-receiver, not having lighted mode selection buttons, provides visual indicators under the frequency display.

### Front panel controls

The manual suggests that you familiarize yourself with the front panel controls and then goes on with seven pages

of short descriptions. This rig has all the knobs and buttons you will need to keep your twisting urges satisfied. Although the number of controls is daunting, the layout is logical and the silk-screened labels very readable (white against black). The left side of the rig has provisions for both .25-inch and 3.5-mm stereo headphones, a three-contact paddle/keyer input and a microphone. Concentric AF gain controls let you adjust audio output from both receivers and allow mixing into stereo phones in the dual reception mode. You can monitor your transmit RF audio, switch antennas adjust sidetone CW pitch and RF power from the front as well as all the standards: SQL, meter select, stepped AGC speed, mike gain, proc and a host of others too long to mention.

The receiver bandwidth module is controlled from its own silk-screened section of the front panel. Second- and third-stage IF filters, both factory installed and optional, can be configured for a wide variety of operating conditions. Both the 455 Hz and 8215 Hz IF stages have filtering selectable at (2nd stage) 2.4 kHz, 2 kHz, 500 Hz and 250 Hz; (3rd stage) 6 kHz, 2.4 kHz, 2 kHz, 500 Hz and 250 Hz.

The control cluster around the main and sub-tuning knobs allows for frequency and operational mode adjustment. The band keypad provides for direct frequency entry, or switching to any of the available amateur bands for the main and sub-receivers. The amateur band switching mode lets you select either of two VFO settings per band, allowing you to push once for settings in the phone section of the band and a second time for the CW or digital portions. Memory input and selection, quick memory, split and dual-channel reception are also controlled from here.

To the right of the front panel you'll find the controls for the EDSP, clarifier, notch, shift and width, noise blanker, antenna tuner and electronic keyer. I haven't included every control because as I mentioned the brief description section in the manual is seven pages long.

### What's around back

As we all know, no matter what you see in the way of enhancements up front there should be an easy way to interface your transceiver to the rest of the shack.

The 1000MP covers this need with a well-laid-out back porch. We start the tour with twin PL-259 selectable antenna jacks. These connectors are always used to feed the antenna for transmit, with or without the antenna tuner, and may be selected for receive function as well. If a separate receive antenna is used, it can be plugged into an RCA-type jack that is selectable from the front. Additional input/output provisions include: CW phone jack; RS-232 for computer interface; digital voice recorder in/out; packet; RTTY; linear ALC; audio in (AFSK or voice); external speaker; low level AF out for recording or amplifier input; ground; band data for external linear or tuner; +13.5 VDC out; transverter drive output; linear Tx/Rx switching and ground; 13.5 VDC input for external DC supply, and AC line in.

In the way of back panel controls the only two are a backup slide switch that enables power-off memory for the memory and VFO settings and a CW sidetone volume adjustment trimmer that I would have preferred as a front panel knob. Additional adjustments (11) are found by way of a top panel access hatch.

### User configuration

One thing that stands out about the 1000MP is its ability to customize the transmitter and receiver parameters to almost any imaginable user preference. The rig comes with over 80 selectable menu options that are divided up into eight subsets. These sets allow for configuration of memory groups, shuttle jog ring tuning speed, IF shift width step, display frequency resolution, transmit audio tailoring, digital mode parameters, and electronic keyer configuration, to mention just a few. The concept here is "have it your way" and Yaesu has gone out of their way to make it so. As icing on the cake, the user button allows you to preconfigure a whole set of operating parameters so that you can switch to a mode such as RTTY or SSTV—with the touch of a button, all parameters for the mode are set.

### Operation

The first time I had an opportunity to really get into the operation of the rig was, as luck would have it, a contest weekend. Although that did not allow

for any leisurely DXing, it did give me a great opportunity to check out all the receive features that are so appealingly described in the manual. I found that the receiver, although offering a multiplicity of options for configuration, was very user-friendly and, with not much practice, I was able to sort the weaker contest stations from the general chaos found on 20 meters. The 2.4 kHz IF filters worked great, giving a nice clean SSB sound, though if you are thinking of using the rig for serious contesting the optional 2 kHz filter would be a plus.

I took the rig down to forty meters to give it a real interference workout and after first configuring the programmable menu for selectable auto or manual notch filter, I found some real nice heterodynes working on a station and kicked in the auto notch function on the EDSP. It performed like magic by wiping out the offending heterodynes with the push of a button. While I was down on 40 meters I thought I'd give CW a try. I switched to a dipole from the multi-band vertical and gave a short CQ. I got a come back from KE4LRH in Richmond and had no problem cutting through the 40-meter QRM using a combination of the 500-Hz filter and the EDSP noise reduction. The electronic keyer was easy to use and had the nice feature of having the sidetone adjustment (pitch, as well as speed of code) on the front; a number of other keyer features are available through menu configuration. The QSK mode worked great and switching between transmit and receive was silent and instantaneous. I worked some more on 40 and then went down to 80 meters. The noise reduction and big quiet sound made copying a pleasure, even on the crash band. The transmit audio was judged very nice by a number of hams I talked to—all in all, the rig performed like a thoroughbred.

I used three different antennas, and the tuner met the challenge without a whimper even on a damaged G5RV. The basic feel of the tuning knobs and controls is one of quality, and the layout, though complicated, is logical and has what I would consider a relatively easy learning curve for such a complex piece of engineering. The 1000MP is a rig that would do the serious contester or DX chaser proud—but isn't too complicated for the ordinary ham who's into multimode communications and wants to step up to a big rig. 75



## 73 Review

## Thanks for the Memories!

*The WB9KZY Island Keyer from Jackson Harbor Press.*

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Designer Chuck Olson (the eponymous WB9KZY) was tempted to call this the "YAK," for "Yet Another Keyer." Fortunately he reconsidered, because the "Island" is a lot more than just another keyer.

Take a look at what memory keyers and kits cost in the marketplace. Here's a complete board kit for \$21.95 that has four separate memories for a total of 500 characters, it's physically tiny (1.5" x 2"), and it can be configured to use less power than your average LED. It has straight-key input, a sidetone oscillator with selectable audio pitch, speeds from 7-48 wpm (set with a pot), and it will even tell you (in Morse) what speed is currently set.

This is a keyer that is physically small enough (and has low enough current drain) that you can mount it inside the smallest of QRP transceivers. Actual power requirements will depend on a number of options, but if you leave out the memory and the voltage regulator, it will idle at less than a microamp. On the other hand, it is so versatile that you may also wish to consider mounting one in its own enclosure as your "main" keyer. Several options are described in the documentation, and you are bound to think of more as you put it together.

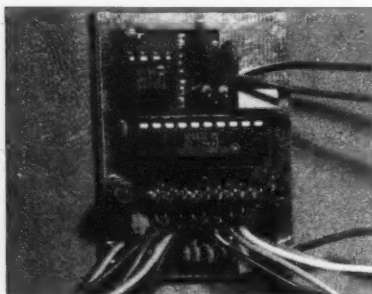


Photo A. Top view of PCB.

There are some features "missing," of course, but in many respects, especially the memories, it is way ahead of the Curtis 8044 series keyers, and costs less than most of the non-memory keyer kits! In his documentation, Chuck acknowledges a few shortcomings. Here they are—decide for yourself how important they are. The Island Keyer doesn't do contest serial numbering; weighting is fixed; it doesn't do automatic spacing, and it can be difficult to load the memories since there is no facility for editing them. Wait a... there *is* a facility for editing the memories. Just ask, and Chuck will send you a QBasic® program and instructions for using your PC to load the keyer!

#### OK, what about the other "shortcomings"?

Weighting is fixed? I see that as a plus. Standard ITU Morse 1:3 weighting is fine for 99% of us who routinely operate slower than 30 wpm, and generally acceptable up to the keyer's maximum speed. Besides which, variable weighting is not all it's cracked up to be—I had no end of difficulty in setting 1:3 weighting on another keyer kit I built. I've heard of people overweighting so that their keyer will sound like a "bug," but in fact what they are emulating is not good Morse—a properly adjusted bug driven by a competent operator should sound just like a keyer!

No automatic spacing? Who needs it? Again, if you change operating speed you have to change your keying methods anyhow, so why worry about the lack of a feature which just encourages sloppiness? And serial numbers are becoming less important as a keyer feature, because most serious contesters are

already using keyboards anyhow, and many contests have dropped serial numbering from the exchange. No, I don't think there is anything of any consequence missing from this keyer.

#### Construction

When you set out to build the Island Keyer, you need to do a bit of planning, because there are so many directions you can take.

First, decide how you intend to mount it (you may need to drill mounting holes in the PCB, and that's a lot easier *before* you solder components onto it).

Then think about power—it's designed for 3-5V operation, and includes a 78L05 regulator. If you leave the regulator out you can power it with a couple of AAA batteries. If you power it with a 9V battery (or a 12V supply) you will need the regulator, but keep in mind that it will draw perhaps a milliamp itself. If you want, you can install a socket for the regulator, so you can pull it (and perhaps also the memory IC) for battery operation. Mine's set up as a stand-alone keyer, so I didn't worry about current consumption and in fact added a power-on LED.

Decide whether you will want to connect a speaker to the audio output. The output is adequate to drive a small speaker, and it is great to be able to check memory contents, speed, or even just to practice without keying a rig. As suggested in the manual, you may also want to add an SPST switch in the output (keyed) line to segregate the keyer from the rig. I included the speaker, and a volume control pot—in fact, I used a Radio Shack™ combination pot and switch, so that the one control would turn it on and set the volume.



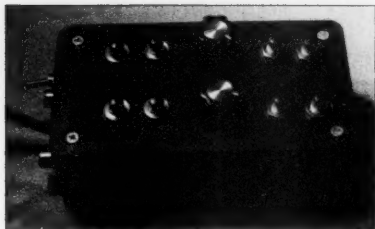


Photo B. Complete!

You should also decide whether you will want to connect a straight key, and if so whether you want the straight key to trigger the keyer or just go across the key line. The documented approach makes sense, so you can use the keyer as a code practice oscillator.

The rig requires 7 push-buttons. Radio Shack sells momentary buttons in sets of four, with two red and two black in each package. The color coding is handy, since there are four memory/send buttons and three function buttons. But what to do with the extra button? I simply put it across the key line as a "tune" switch.

Finally, if you ask for them, Chuck will provide instructions for adding in a simple delay timer based on a 555 timer chip. It requires one more pot and a couple of resistors and caps, but it is an easy way to set up the keyer as a beacon, or for repetitive CQ calling with a variable delay.

I'd suggest that you install wires for each of the off-board connections, even if you don't intend to use them. If you decide to add something later, it will be a lot easier to connect it to the existing wire than to try to connect a new wire to the board after it has been installed in a rig or box.

Building instructions are included with the kit, and if you have modest skills you will have no trouble in completing the project in about an hour. There is some tricky soldering involved, due to component spacing, so you will need to use a low-wattage iron with a fine tip, and work under a magnifier (or at least check each joint with a magnifier). Take your time, and watch for solder spatters and drips.

The two ICs (CPU and memory) are static-sensitive devices, so exercise the usual care in their handling—keep handling to a minimum, and make sure you are grounded; for example, with a clip lead between your wristwatch and a convenient grounding point.

I installed the completed keyer in a small plastic box with holes for the speaker in the bottom; the eight buttons and two pots on the top; and jacks for paddle, straight key, and output, along with an output toggle switch, on one end. You may want to use a metal box if you will be using a lot of RF power—the microprocessor may be susceptible to interference, but no problems were found in my QRP operating environment. The power cord exits from that end of the box and terminates in a Molex™ connector. Here's a handy hint for you: Calculate what size box you need, then get one that is half-again as big! No matter how carefully I measure and plan, I always seem to end up having to sit on the box to get the lid closed.

### The smoke test

As you might expect with a kit having so few parts, there's not much that can go wrong if you did a good job of soldering. Once you've connected power (and assuming you've connected a speaker), just press the speed button—the keyer should send Morse numbers reflecting the currently set speed in wpm. Then connect a rig to the output and see if the keyer does, in fact, key. If connecting a rig is not convenient, just connect a multimeter across the output, set the keyer for its slowest speed, and observe a change in resistance as the circuit is keyed. Finally, check memory operation by loading a character or two into each memory, in accordance with the instructions.

If the keyer fails any of the above tests, take another look at component placement and examine the solder joints. And if you *still* have trouble, get in touch with Chuck at Jackson Harbor Press.

### Operation

This is a nice keyer to use. It keys precisely, and doesn't seem to have much "feel." By feel, I mean operating characteristics that take some getting used to, so lack of feel is a good thing. But the ability to practice keying without connecting a rig is a real plus. Another feature is that if you connected a straight key jack to the straight key input (rather than across the output) you can use the keyer as a code practice oscillator and sharpen up your hand-pump skills.

The controls are simple—separate pots for sidetone volume and speed, and seven or eight buttons. Four buttons are devoted to the memories; one reports speed; one stops memory sending; and one triggers memory loading. As stated, on my version an eighth button goes across the key line as a "tune" button, and the volume control also serves as an on/off switch.

To load a memory, you simply press the load button followed by the button corresponding to the memory (1-4) you want to load. The keyer will respond with "?" from the speaker, and then it's just a matter of keying in the text you want to store. Automatic character and word spacing are enabled during memory load, so you can take your time. Press the load button again when you are finished, then the memory button to play back the recorded message. The total unused memory capacity can be considered as "available" to any unused memories, so, for example, memory one can contain up to 500 characters. Memory two can use all but the first 120 characters, and so on.

The Island Keyer is a lot of fun to build and a lot of fun to use, representing outstanding value for the money. In doing this review I spoke to Chuck personally, and found him very helpful as well as very interested in suggestions from users for a possible "upgrade version." One of the great benefits of programmed keyers, as compared with, say, the 8044, is that an upgrade will be just a matter of popping in a new chip.

### Availability

The WB9KZY Island Keyer kit, consisting of circuit board and all board-mounted components, is available at a cost of \$21.95 (+\$2.00 shipping/handling) from: Jackson Harbor Press, RR1, Box 91C, Washington Island WI 54246. Phone (414) 847-2761; E-mail: [chuckolson@juno.com]. Credit card orders (only): (800) 238-8205.

*Author's note: After reviewing this keyer, I found myself so impressed and pleased with it that it's also now available from my own company, Milestone Technologies. We also have available a "hardware pack" containing the necessary pots, knobs, switches, jacks, and a speaker. Our Web site is [http://www.milestonetechnologies.com/mthome].* 75

# ON THE GO

## Mobile, Portable and Emergency Operations

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A few years ago, a friend of mine said to me, "Disaster communications isn't one of the reasons for the amateur radio service—it's the *only* reason! The radio frequency spectrum is too valuable to give to anyone just for hobby use, especially the number and different types of bands available to ham operators. The government lets us have these for support in disasters; if there's no disaster, go ahead and have fun!"

He was definitely right about the value of the radio spectrum. As we've seen recently, not only is there more demand for access to it, but also the government has found that frequencies can be sold for substantial amounts of money. We are privileged to have access to choice portions of so many bands. While DX, rag-chewing and contesting are fun, they do not justify the investment the government has in amateur radio frequencies. Amateur communications in support of disaster relief is one of the best ways we have to provide enough value to society to allow us to have one of the best playgrounds in this universe.

Naturally, there are other services which are positioned to provide similar support, and they will use such claims to justify expanding. Most public service agencies, such as police and fire departments, now have multiple radio systems. Cellular telephones are almost as common as cassette tape players in cars. These are often viewed as having eliminated the need for our traditional role. Fortunately, amateur radio does provide a number of advantages over other services, and acts as a significant augmentation to the communications services used in daily public service operations.

### Portability

The days when an amateur station was a large tube-driven stationary system are long gone. Hand-held and mobile units predominate in the VHF and UHF frequencies, and there are so many 2-meter and 440-MHz repeaters that the frequencies have to be coordinated. Most modern HF rigs can be carried in one hand and powered from an automobile battery/alternator as well as from a 110-volt to 13.8-volt power supply. An amateur station can be quickly set up in a location which has inadequate or non-operational communications. This means that a shelter set

up in a school gym can be quickly plugged into the emergency network.

not everyone is as comfortable with taking detailed messages as hams are. More importantly, a well-run, properly disciplined network will less likely be jammed by would-be users. Cellular systems, on the other hand, can be overloaded during normal operations in some areas, and have significantly higher usage during emergency situations.

### Coverage

Although not every repeater has long-term battery or emergency power, usually there are adequate reserves to allow for initial operation. After these reserves are exhausted, it is possible to set up portable repeaters or arrange for auxiliary power for the repeater. For wider area coverage, the high frequency bands can be used to permit longer distance communications. And, when all else fails,

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***"Cellular telephone systems can get overloaded in normal usage; in emergencies they jam up."***

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up in a school gym can be quickly plugged into the emergency network.

### Multiple simultaneous contacts

While cellular phones have grown in popularity, they do not lend themselves to disseminating certain types of information. Since each intended recipient must be individually contacted, multiple calls must be made for each message. With amateur radio, all stations on a given frequency can be simultaneously made aware of the same information. Frequencies can be assigned to allow one network to provide general communications, another for command functions, etc.

### Training

It seems that almost everyone these days is as comfortable with the Internet and World Wide Web as they are with the telephone. However,

it is possible to utilize the old-fashioned method of relaying messages.

### Cross-coverage

Because of the portability of amateur radio, and the range of frequencies available, hams can act as a bridge between various agencies. In many cases, police department radios may not be able to communicate with the fire department, or neighboring police departments; the Red Cross frequencies are different from both; and the National Guard uses military frequencies which are different still. Amateur radio operators can be stationed with the communications people of other services and pass traffic from one service to another. Likewise, it's not unheard of for a ham stationed at a police or fire dispatching post to spend 90% of his or her time backing up the dispatchers on their equipment and 10% on the ham bands.

### The price is right

The government agencies which the amateur service supports receive this support at no cost. As amateurs, not only are we expected to provide emergency communications, but also we are prohibited from being paid. In addition, we show up with our own equipment! It would be tough to find a better deal.

### Enthusiasm

Let's face it, in an emergency situation requiring the support of ham operators, we tend to show up charged with a healthy dose of adrenaline. Amateur radio is one of those special hobbies which gives us the chance to make an important contribution to our community. In doing so, we are using many of the same communications tools and techniques that we count as fun on other days. In my experience, when the call goes out, the response is overwhelmingly positive.

### Diverse talent pool

Hams represent a fairly broad spectrum of talents. Sometimes these other talents allow assignment of people to locations where they can really hit the ground running. Hams with health care backgrounds, for example, can be assigned to hospitals; those with a military background are a more natural fit for the National Guard. It is amazing what some hams are capable of doing. During the aftermath of a tornado a few years ago, I was impressed by the extreme smoothness of the net control operator. He kept track of everybody's name, call sign and location, better than I could have with a computer. Later I found out he was blind, was used to keeping all these facts as mental notes, and had no need to refer to anything to refresh his memory.

There are lots of possibilities for the amateur community to provide key service in an emergency situation. However, this is not an automatic guarantee that hams will be ready, willing

and able to follow through. There is also no guarantee that our services will be welcome. If you were a mayor or a city manager facing a crisis, would you realize that amateurs were a resource at your disposal? How would you let them know they were needed and coordinate their activities? A lot of work needs to be done before the need arises, but fortunately most of the work is fun, interesting, and more satisfying than exchanging RST, rig and antenna information.

This column will explore a number of different aspects of emergency communications. Since there are many excellent organizations throughout the country, I'll try to get

**"Amateur radio gives us a chance to make an important contribution to our community."**

different viewpoints on what works well. We'll explore network operations, different types of equipment, setting up portable stations, coordinating amateur activities with local government operations. Likewise, we'll look at the types of emergency service support required in different situations. What's needed for SkyWarn weather spotting is different from what is needed following an earthquake. Winter storm situations place a different demand on operators than a hazardous spill situation. We'll also look at managing an operation—while the response in the early stages of an emergency is strong, how can we maintain that response days or even weeks later?

I hope you'll find this column fun and interesting. If you've got ideas, please feel free to send them either by E-mail to 74640.1442@compuserve.com or by snailmail to the address at the top of this column.

**NEVER SAY DIE**  
Continued from page 49

**Our Story**

Time was when I'd get several ham-promoting newspaper clippings a week from readers. Now, it's rare. Sure, I've tried to sell the idea that every ham club should have a PR officer whose mission is to make sure that meeting notices are published in the local newspapers and provided to local radio stations, but even more important, to make sure that any club or member activity that provides a possible excuse for newspaper, radio or TV coverage is exploited. Field Day? Get a story and photos to the newspapers before and after the event. Any emergency services ditto. If there's a local school radio club get the story into the papers. If someone in the club makes DXCC or wins a contest, get photos and a story to the papers. We need visibility and we need it desperately.

My thanks to Ed Lappi AE4EC for sending a copy of the Chapel Hill Herald, where there was a full page story of the local school radio club. But I should be getting clippings like that every day, not once every few weeks. Get on the stick, clubs.

**Talk Radio**

Back in the '50s Jean Shepherd K2ORS got started in radio broadcasting in Cincinnati, as I recall. Soon he had a nightly show on WOR, clear channel 710. He was on from around 11 pm until 5 am nightly. This was not talk radio as we know it today. Jean just sat there and talked for six hours a night, with no call-ins to take up the slack and no guests to interview. And Jean built up one heck of a following. Then he got into writing, with a bunch of prize-winning stories published in *Playboy*, a series of great books, and eventually he wrote a string of wonderful movies.

He was followed on WOR by Long John Nebel, who brought in guests to interview and built a huge audience by getting into the weird stuff. These days he'd have contactees and such.

And that's pretty much the Art Bell W6OBB formula. He's on nightly from 11 pm to 4 am PST on over 300 radio stations. Some only carry his program for three hours. The only station I can

hear well is WTAM in Cleveland on 1100 kHz, and they only carry three hours. Art interviews some very interesting people, plus he also lets the audience call in to ask questions and make comments. He gets into very weird stuff at times.

I keep a little radio beside my bed and, if I happen to wake up during the 2-5 am slot, I check to see who he's got on. Just in case he has something I wouldn't want to miss, I set my video recorder with the radio input to the audio jack, and record the three hours every night. Well, it's something to listen to while I'm opening my mail, and these days that often takes an hour or two.

Check the broadcast band some morning and find out which station brings in Art's show best for you. And every now and then you'll hear me being interviewed.

My interviews on his show have resulted in letters from listeners in all 50 states, Puerto Rico, the Virgin Islands, and even Israel and UK. The last two are from an Internet "broadcast" of the show.

I've got so many things to talk about that sometimes I think

about having my own show. But something like that ties you down, and I still have a bunch of countries I want to visit that I haven't seen yet. So I'll have to make do guesting on talk shows. But if I were to do my own show it would be different from any other I've heard. My aim would be to get people excited about improving their lives. About getting healthy. About making money. About self-education. About making our lives better through a much smaller government. Through re-inventing our school system. About eliminating poverty and the drug problem. Making prisons less of a growth industry. Well, you know, all those things I've been writing about.

But, would it sell? Probably not. Heck, I haven't been able to get you interested in living longer or getting healthy, so perhaps I'm just spinning my wheels.

Sure, you want me to write about amateur radio. Fine. But when I ask you to write and tell me about the most exciting times you've had with the hobby I get *bupkis*. Ham radio has provided

Continued on page 77

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CIRCLE 163 ON READER SERVICE CARD



# THE DIGITAL PORT

Jack Heller KB7NO  
712 Highland Street  
Carson City NV 89703

## How to get the most out of your local PBBS

Would you like to get better acquainted with the strictly-for-hams bulletin boards and stay posted on such hot items as DX propagation, AMSAT information, the latest from the FCC or what your local club is up to? You can also hunt for bargains for your ham shack or clear out some of your own clutter for cash—there is a continuous swap meet in progress and you can visit it from the comfort of your shack. Plus, there are no membership costs, and it is available 24 hours a day.

You will be well rewarded for the time you spend getting to know the ins and outs of your local ham packet bulletin board system (PBBS). If you have been letting this exciting technology pass you by because you just didn't want to learn another new thing (and it looked expensive), getting started is easy—and can be accomplished on a budget. And you'll have fun learning something new, and that is what a lot of ham radio is about.

## Learning experience

I strayed from the norm a little and was exploring the node portion of the local system. In the *Just*

*Heard* category, there were about a dozen callsigns, and one of them had a "-1" extender on it. I thought it would be fun to leave this ham a message in his mailbox—hardly anybody gets personal mail that way.

I was connected to the node okay, but my attempts to connect to the ham station were continually rebuffed. The command [c kb7xxx] just wasn't recognized. As they say, when all else fails... I remembered, once again, why I go to the effort to download the user manual from the local node/bulletin boards when I first get acquainted with a new one. The user manual spells out the steps to take. It is necessary to designate the port number on this system to make the connection and presto! There I was in his mailbox. A few days later, I received a nice note on the PBBS after he found the message. I look in on the PBBS frequently as it is a good source of recent happenings both locally and across the country.

So how do we overcome these little frustrations? Unless you have psychic gifts and can read the mind of the person who wrote the software, the easiest method I have found is to read the manual for your local PBBS.

## Where do you get it?

Every bulletin board I have seen has a user manual readily available for download. Most of

the bulletin board systems have more than one function. In the case of the local system, there is a node available for connecting to other digital stations in the area or to other nodes. The node, in its simplest form, can be thought of as a repeater. The node has a different identifier—I can connect to it by telling my packet station to connect to CARSON. Once connected, a series of commands is available (see **Photo A**). These commands are similar, but not related, to the commands of the BBS.

The bulletin board (PBBS) can be connected to after connecting to the node, so you can think of them as individual stations on the same frequency doing different jobs. If they are both busy, though, the throughput will be reduced because they follow a polite protocol and wait for each other to finish before they proceed with their particular task.

Intermingled with this is another function, the database. Your PBBS operator (sysop) has a computer dedicated to this entire operation and you have access to many files residing on his hard drive. One of these will be the user manual.

On the local system I found my user manual by typing the "W" command (**Photo B**). "W" is a pretty standard command used on many systems and it translates simply to What [is there?]. You will get a listing of the files and subdirectories of the database. In the local database, there is a file, USERMAN.DOC, and when I downloaded this I got a 24-page text of how to use the PBBS. You'd better believe that I printed it.

If your system does not have a "W" in the command line, type "H" for Help and it will reveal an abbreviated list of what all the commands can do. If you do not see a hint of where you might find a manual, send the sysop a message and tell him you are an avid reader and need this information for your library. He will tell you how to get it.

I learned, once again, how helpful and encouraging the ham community can be, when I first committed to enter the digital spectrum. I reside in an area

where it's very difficult to make good solid contact with any VHF node, because this valley is surrounded by real mountains. That plays havoc with line-of-sight communications and especially with packet where the strings of information come in fairly long bursts.

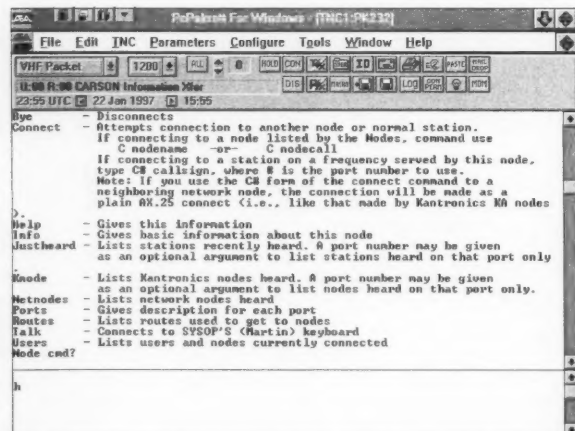
To understand why that is a problem you need to understand a phenomenon known as multipath. You can work FM repeaters all over this neck of the woods and the multipath, though it exists, has little effect. With a packet transmission, however, it can be a disaster. Regardless of the power, if the signal bounces off a mountain, the received signal hits the antenna two or more times and turns the data string into mush—and software just can't decipher it.

A few years back, the closest PBBS was on the other side of the mountain. A direct connection was difficult to establish and nearly impossible to maintain. Transferring intelligible information was hopeless. I solved the problem for a time by setting up a digipeater out in the middle of the valley. It consisted of an IC2AT and an MFJ 1270 with a Commodore 64 to load software and monitor the activity.

This worked but it was slow and it was buggy. I frequently had to trek across town to reset the TNC, a great experience, because when you exercise the gray cells they get stronger—and I felt I had overcome the evil multipath demon. After a few years, I had to take the system down; it was at my business location and I decided to stop doing business. It was the best decision I made in years, but I was virtually out of packet radio.

To the rescue came a local ham who set up a PBBS, right in the line of sight I needed to regain access to the packet bulletin board system, and without having to go through two repeating processes. Working packet is now the pleasure it should be.

Those of you who use services such as CompuServe, AOL, and the Internet take a lot of this transfer of information for granted. The on-line services store and move massive amounts of data in



**Photo A.** Opening screen to node. A series of commands were listed after hitting Enter on a blank screen. One of these was Help. I merely typed the "h" in the lower "transmit" box, hit Enter, and slightly more than a screenful of instructions scrolled up the screen.



all forms, including text, graphics, and sound, accurately and speedily down the phone lines.

The amazing thing about this is that, except for the speed, we can do all this via our radio connections. That's right: Most of the data passed through the packet radio system is in basic text format with no fancy fonts, and the pictures, if drawn, are done with keyboard symbols. However, it is possible (and some hams are doing it) to move binary files such as word processor data, graphics, and even sound files through the packet system. And one day, maybe even the speed bumps will go away.

There is quite a proliferation of ham bulletin board programs, so it would not be reasonable to attempt to list all the variations of commands and what they do for each system. Here I find a command line listing with 21 of the 26 letters of the alphabet—and that's just the beginning. When you get the inside dope on these commands, many of them are combined with three or four other letters for variations of the command to help you become more efficient.

"A" is a nice simple command that stands for Abort the operation you have in progress. They can't fool with that. "B" is another common no-brainer that allows you to disconnect from the PBBS. Now "C" becomes another story. On a node it is used for connect, which seems straightforward enough. The system I am working into has some variations. If I were connected to the node and wished to connect to another node or station I would normally type in [C callsign]. This system requires a port number after the "C" and then the callsign.

When I connect to the PBBS, that "C" is another story. It then stands for conference. Well, not very many keyboard conferences are held, but there is a way and I guess this double use of letters just shows that we don't have enough letters in our alphabet.

**Photos A and B** are screen captures so you can have a look at my screens as I use my current (AEA) computer program. There are many good programs on the market these days. The best way to get comfortable with software

is to find a neighboring ham who'll show you what he is using. If it looks like something you can handle, you have a built-in tutor. The next best is to jump in and figure it out on your own. It's not as difficult as it may seem.

If you are looking to get the most bang for your buck, there are several factors to consider. If you are going to concentrate on packet for the foreseeable future, several choices are available, including MFJ, Kantronics, BayCom and PacComm. If you can come up with a used TNC and need software, there is a good selection of packet software that won't put you in the poorhouse. You can buy all new (except for the radio) and get into packet these days for \$50-150 (more about that part next month).

Hams use programs of all kinds, from telephone terminal programs to a variety of dedicated programs, such as the one I am using; they all tell the packet system at the node or PBBS the same commands. The fancier systems use the power of your computer to accomplish keyboard shortcuts so you can get on with your hamming and not spend all your time typing in commands.

Communications software used in ham radio isn't the same as in word processors or following hypertext links around on the Internet. This stuff forces you to get a little more involved. By that I mean it won't let you get away with a thing. If you want to use your computer for ham communications, at least study the operational commands and keep a list of them handy when you are making contact. When you first use any program, it is helpful to keep a few notes close to the keyboard until you get the hang of things.

As you may guess, the modern programs are equipped with help windows for ready reference, so you can usually look anything up within a half minute. In fact, it appears the entire instruction manual is contained in the help files, all categorized alphabetically. It is usually faster than finding the correct page in the hard copy manual.

I have occasionally had to eat a ration of humble pie for not remembering a command in the middle of a live contact on HF. If



**Photo B.** Opening screen for BBS. The first four lines appeared, then I entered the "?w", pressed Enter, and it displayed information about the "W" command. Then it redisplayed the command line and is now waiting for the next command.

or when this happens to you, you'll find a lot of hams on the other end of the keyboard who are very reassuring, so don't be afraid to try something new.

#### Can we talk?

If you have questions or comments

about this column, E-mail me at [jheller@sierra.net] and/or at CompuServe 72130,1352. I will be glad to share what I know or find a resource for you. On packet, when you get a chance, drop me a line at: [KB7NO@N7NPB.#NONEVNV.USA.NOAM]. For now, 73, Jack KB7NO. **75**

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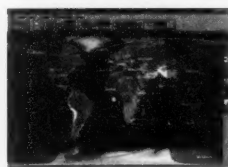
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CIRCLE 226 ON READER SERVICE CARD

# HAMS WITH CLASS

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## Space Covers: History In Your Hands

Several years ago, Lynn A. Breece K4LFV, Lt. Col. USAF (Ret.), contacted me after reading several articles about my work with young people in ham radio and about my involvement with the space program.

Lynn began sending unusual and beautiful wall posters of the space shuttles to our classroom. One day, something really special arrived in the mail for the children. Our friend had meticulously collected and assembled two space cover albums for us. Space covers are special commemorative envelopes from the US Postal Service with the mission patch or insignia on them, that are canceled at the launch site. The two albums Lynn sent us contained space covers and memorabilia from STS-30 and STS-34. The children in my 6th, 7th, and 8th grade radio classes were delighted with the albums, which contained the canceled envelopes, newspaper clippings, and a collection of reports about the missions.

A letter writing exchange soon began between Lynn and my classes. The children eagerly looked forward to the many albums and kind letters he took the time to send to us. In October, 1991, Lynn wrote us a beautiful letter describing how he got started in the fascinating hobby of collecting space covers. The children and I agreed that Lynn Breece was one of the most interesting hams we had ever met.

In 1961 Lynn started working at Cape Canaveral and the Kennedy Space Center. At that time, the post office closest to the Cape was in Port Canaveral, Florida. For this reason, you can find covers canceled at Port Canaveral for the launch of Alan Shepard in the first Mercury capsule.

As the Mercury launches proceeded and the Gemini Program got underway in 1965, cancels began to come from the cities of Cape Canaveral, Cocoa Beach, Satellite Beach, and a few other towns which were close to the Cape.

In 1965, the post office at the Kennedy Space Center was opened so that all the NASA launches could then have a cancel from the Kennedy Space Center in Florida. It was standard practice for the post office to

cancel covers on launch day as long as the covers were mailed before the set day or were hand-carried into the post office the day of the launch.

Lynn told us that in all the years he's been collecting covers, he has found postal employees to be very cooperative in supplying the proper cancels on the right date. He particularly praised Mr. Al Moore and his staff at the KSC post office for supplying superior service to collectors.

As the space program grew, more and more cover collectors appeared on the scene, including the strictly philatelic ones (collectors of postage stamps). This meant more cachets, different types of covers, and cancels from all sorts of places, such as a town where a particular astronaut was born.

Lynn chose to specialize in getting astronaut signatures on covers; but he also includes NASA officials, scientists involved in the program, cap coms, test directors, launch directors, etc.

The astronauts and others involved in the space program were always very happy to sign covers for Lynn. He wrote the children: "As someone who has lived most of my life in this century, I believe I have seen more history-making events than those living in previous centuries."

"When one considers the space program alone, think of what we have witnessed just in the last 36

years," Lynn points out. "Man's landing on the moon will go down in history as the single greatest scientific accomplishment of the century."

Lynn often followed up our letter exchanges with radio contacts to our classroom. He always felt that young people were the life blood of any organization or hobby. Without youngsters and the enthusiasm and energy they offer, a club or organization would eventually die out. These were always the things he and I would talk about through the three years we knew each other. Lynn was very interested in motivating young people to get involved in ham radio and in the space program.

He always encouraged the children to get involved by collecting space covers, attending launches, visiting NASA centers, reading about space, and talking to hams on the radio with mutual interests.

A ham since 1932, Lynn loved the idea of teaching ham radio to young adults, and continued to be supportive of my program until his death three years ago. His expressed admiration for the children who studied the theory and rules, and who practiced the code and got their licenses, was surpassed only by the warmth and respect my kids felt for Lynn. Through my radio classes, Lynn found an outlet through which he shared his enthusiasm and interest in space and ham radio.

Lynn always hoped that children would look at the past space covers and remember the events they mark. "To own a cover which was canceled on Moon Landing Day or on *Voyager's* closest encounter with any of the planets is to hold a piece of history in your hands. It is a record of a great event, and one that will stand through the years," Lynn affirmed.

There is a permanent tribute to this wonderful ham friend in my classroom at Intermediate School 72 in Staten Island, New York. All the beautiful space cover albums Lynn sent us through the years are on display for students to keep enjoying and learning from. His love for space and radio will long be remembered and passed along to a whole new generation. 73



Fig. 1. Postal covers are commemorative envelopes issued by the US Postal Service in honor of historical events.

# CARR'S CORNER

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## More on ham software

Well, it seems that my complaints about ham software seem to have hit a resonant chord. I received a large amount of E-mail and snail mail from people with one complaint after another. The suspect software covered everything from antenna analysis to terminal node controllers to information databases. It seems that almost all forms of software were involved.

The most frequent complaint was on MS-DOS non-Windows® software. We are seven years into the Windows era, so there is no excuse for offering MS-DOS software any longer. Also, Windows software writing used to be a big deal, but now Visual Basic® and Visual C® are on the market and make the "...contriving of contrivances a game for all..." Visual Basic 5.0 should be out by now. It is said by beta testers to run as much as 20 times faster than VB4, and now competes with Visual C speedwise.

## Some guidelines

I would like to offer some guidelines for developers of ham software. I would also like to hear from experienced software developers who have other ideas. Keep in mind that I am not sounding off from any "high horse," because I readily admit that I've made all the mistakes I've complained about in others. But I also bought some books on human computer interface design (see list below) and learned a bit of stuff.

The three pillars of design are usability, functionality and aesthetics:

- Usability means that users can easily learn to use the interface (screen) and then efficiently interact with it.

- Functionality refers to the functions and controls that are available on the screen, and their optimal use.

- Aesthetics refers to the appearance, spatial layout, and color scheme. Ask whether or not it enhances or takes away usability and functionality.

Another attribute of a good program is consistency. It is very important to design the program so that the system always interprets user actions the same way from event to event. It should also respond the same way to different instances of the same event. If you make a change from expected behavior, or design an interface that does not match the Windows

## ***"There is no excuse for offering MS-DOS software any longer."***

standard, then make it a large and obvious change so that users know it is not a standard presentation.

Color is one of the most frequent icky things about computer interface design, and leads to what one authority called "color pollution." Some people seem to think that the more color the better. Or that sexy-looking colors are neat to use.

Color should be used to make things stand out, especially at the specific times when needed. If there are too many colors on a screen ("color pollution"), then the user has a difficult time finding things. Normally, dim or dark colors (deep blue, Microsoft gray, etc.) are better for screens than most light colors. Also, solid colors generally work better than the pastel shades, especially where the standard 8-point type is used on labels placed on the screen.

Color differences can be quite useful when you segment a screen. You can use colors to divide a screen into separate tasks or classes of information. Also, it has been found that color works better for experienced

users than for "newbies." If the principal audience is people with little computer experience, then stifle the color.

Long load times are often required for programs. Unfortunately, a long load keeps blank stuff on the screen and that makes users nervous. The user will then start hitting keys or clicking the mouse inappropriately and make the program do odd things. About ten seconds' load time is considered excessive by most users. There are several things that can be done about it:

- First, a splash screen can be provided. This is a screen, usually without borders, that appears as soon as the program loads. It remains on until the entire program is loaded. It typically does not have graphics or any controls because these take too long for loading. In some

cases, a 200-mS (or so) timer control (as in Visual Basic) may be used to load the rest of the program from the splash screen Load Event.

- Another trick that can be used is to provide a progress bar. That's one of those green or blue bar graphs that show the percentage of completion. Alternatively, an on-screen message could be provided.

Some questions that you should ask include:

- Does a desired feature have a performance effect? If not, then dump it unless there is a good reason to keep it.

- Is the feature likely to confuse the user? If it does, dump it or redesign it.

- Are any of the controls, functions, or features non-value-adding? If so, then dump them.

- Can controls be combined or eliminated? If so, do so.

- Is the interface as intuitive as possible to the user? If not, redesign it. For the most part, this means that the program should follow the Windows standard format because that is what the user will understand.

## Testing

Testing is a necessary although often not sufficient means for telling how well the program works and ferreting out bugs. Unfortunately, most ham software seems to be tested by the programmer, rather than by a typical user. Programmers make lousy testers because they are usually too close to the program. They can easily overlook obvious problems because they have little mental workarounds. They know how the program is supposed to work, so they may overlook some obvious errors that typical users might make. They are also confident using computers, where real users might be frightened of the machine. The goal is to make the user population as representative of the customer population as possible, even if it means giving away free beta testing copies.

Observing testers can sometimes be a problem. The tasks they are asked to perform should be realistic and truly representative of the tasks normal users will face. The tasks should also cover the full range of possible situations, although my answer to trying to figure all of them out is, "Good luck!" Also, the observer should be as unobtrusive as possible. The presence of the observer should in no way alter the performance of the user. In general, having someone looking over the tester's shoulder will induce more errors than is normal.

## **Books on human computer interface design and related topics**

Laurel, Brenda (1990). *The Art of Human Computer Interface Design*. Apple Computer (republished by Addison-Wesley).

Preece, Jenny (1994). *Human Computer Interaction*. Addison-Wesley.

Tufte, Edward R. (1990). *Envisioning Information*. Cheshire CT: Graphics Press.

Tufte, Edward R. (1983). *The Visual Display of Quantitative Information*. Cheshire CT: Graphics Press. 75



# HAM TO HAM

## Your Input Welcome Here

Dave Miller N29E  
7462 Lawler Avenue  
Niles IL 60714-3108

How about some more good, down-to-earth tips and ideas to make our hobby more enjoyable and perhaps make it run a little more smoothly? And speaking of running, I'm running a little low on ideas, so please don't put off sending your favorites. Just jot down some things that have made ham radio problem-solving easier for you or for one of your friends, and send them to me at the address above. Uncle Wayne's elves will send you a check for \$10 each so that you can afford to buy a couple of the books on his "must read" list. He's recommended some very interesting ones... and here are some other interesting tips:

### Superman's AA cells

Looking for a super-capacity AA cell? If you use rechargeable AA cells in any of your portable gear, as I do, it might be worthwhile checking out the relatively new line of NiMH (nickel metal hydride) rechargeable cells. The NiMH chemistry automatically increases the mAh (milliampere-hour) capacity of a rechargeable cell by roughly 25%, and the new AA size NiMH cells boast an 1,100 mAh capacity (a 250-mAh increase over even their newer 850-mAh NiCd counterparts). NiMH cells can be charged in the

same manner as NiCds, using a one-tenth-capacity constant-current charger (110 mA constant-current for the 1,100 mAh NiMH cells mentioned). The NiMH chemistry has less tendency toward "memory effect" than does the NiCd formula and the cells can withstand more heat. All in all, a worthy competitor to the venerable mainstay of our rechargeable repertoire of cell chemistries. One source of rechargeable NiMH "AA" cells is DC Ace Electronics (847-821-8122), who lists the 850-mAh "AA" NiCds at \$2 each and the 1,100-mAh "AA" NiMHs at \$2.50. When you compare these prices against the name-brand

### CBer's PL

From Gary Holoubek WB6GCT: "Ever heard of 'CBer's PL'? That's the name I've given to the alternator whine that can be heard on all too many of even the best of ham radio mobile installations, and nearly all CB mobile signals! I thought I knew all about such problems until I installed a bank of radios into a friend's 1990 Lumina. My friend and I both enjoy having 3-band capability (146, 220, 440 MHz) in our mobiles, and it took me several days to design and build the hardware to stack the equipment between the vehicle's floor and dashboard in a neat vertical rack array. Today's small cars can often be a real challenge! Everything worked fine... that is, until I did some customization... and that's when Murphy struck!

**"When you compare these to the name-brand alkalines, the choice is pretty clear..."**

"use-em-once-&-toss-'em-away" alkaline cells, the choice is pretty clear... especially for battery-operated equipment that's used a lot. Though the better alkaline "AA" cells are rated at 2,450-mAh capacity, 2 or 3 uses from the NiMH cells will quickly put you in the "money-ahead" bracket. Fig. 1 shows the basic constant-current NiMH 110-mA "safe" charger that I've been using for the "AA" cells in my GPS receiver.—**Dave N29E.**

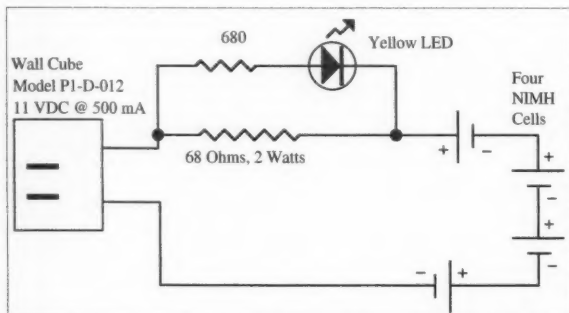
"Knowing that microphones sometimes never make it back to their correct hangers, and with use, could become a confusing tangle of microphones and coiled cables, I decided to use only one microphone for all three radios and switch it to the desired transceiver with a rotary selector switch mounted in a mini-box. The three transceivers are all Yaesu, and fortunately, they use the same type of microphone and pinout connections. Sounds simple enough!

"The microphones are of the 8-wire type, with signals for microphone audio, up/down frequency control, speaker audio, +5 volts for powering the Touchtone® circuit in the microphone, and of course a common ground for everything. With a little bit of imagination, I thought of all the different things I could possibly do to make this a really whiz-bang installation. Realizing that the radios would be used at night and the position of the transmitter selector switch knob would not be easily visible, I decided to use the +5 volts in the mike cable to power three LEDs... which would

indicate which transmitter the microphone was delegated to. I even used a different colored LED on the switchbox for each of the three transmitters. This would allow the operator/driver to determine which transmitter was 'ready-to-go' at a glance. It worked great! Even the speaker outputs from each radio were run through the switching box and an output jack made available to drive either an external speaker or a headphone for 'silent running'... all automatically switched with the microphone. Hey, no telling what an engineer can do with a little time and imagination!

"When all was said and done, I ran into an interesting problem, something I'd not anticipated. At times, when switching the microphone via the switchbox, the transceivers would key into transmit briefly. I theorized that the problem stemmed from the fact that the Touchtone keying circuit in the mike—which was powered by the transceiver's +5 volts—would create a spike on the +5 volt line as the switch was rotated and the power to the mike's TT circuit was pulsed on and off (I was using a break-before-make rotary switch). After installing three diodes, so that the microphone could draw power from all three radios but without allowing the +5 volts from one radio get into another, the problem disappeared. One of those 'little things' that doesn't show up until you actually put an idea into practice!

"Now everything was working fine until my friend actually drove the car! Yep, you guessed it. 'CBer's PL.' But I couldn't see how the alternator whine was getting into the transceiver's audio. I had brought the power for the transceivers directly from the battery and had even used a 30-amp relay to switch the rigs on and off with the ignition key... same as the regular car AM/FM radio. This allowed my friend to keep the audio volume controls in the same position and ensured that all of the rigs were OFF when leaving the car, and ON whenever the ignition was ON. I even installed a switch on the radio console to select either the ignition switch or direct battery power to enable the relay. That way the radio stack could be powered up without the



**Fig. 1.** A constant-current (110-mA) nickel metal hydride charger circuit suitable for charging four NiMH cells in series. The value of the 68-ohm resistor may need to be adjusted to achieve 110 mA, depending upon the characteristics of the transformer that's used. See text for further details.



ignition key for those times when operating mobile at a fixed position (as might be done during extended public service duty) was called for.

"In trying to figure out just what was causing the 'Cber's PL' problem, I did what every budding engineer (?) does when he has a problem. I talked it over with anyone who would listen! Following the suggestion of another technically-oriented ham-friend, I disconnected the two unused mike cables that run between the switchbox and the transceivers, leaving only the active one in use. No help. Of course, the alternator whine was gone with the microphone connected directly to the transceiver, bypassing the switchbox entirely...but the switchbox was such a neat idea!

"So one weekend, armed with a portable scanner receiver set to the transmitting frequency in

since the alternator is mounted on the engine, and thus grounded to the engine, and the vehicle's negative battery terminal is also grounded to the engine via a nice thick cable, a classical ground loop was to exhibit itself. And it waited there patiently just for me to come along!

"The bulk of the alternator's ground current will travel via the heavy cable to the battery. But what I had done by grounding the switchbox to the radio stack bracket was to provide another path for the electrons to get to the battery via the car frame ground in the switchbox; then to the transceivers via the microphone cables; and finally to the battery via the transceivers' power wiring. Admittedly, the actual current through the microphone cable was probably small, but not all that much is needed since the microphone is a low-level circuit whose audio is greatly

**"Everything was working fine until my friend actually drove the car."**

hand, I decided to get to the bottom of the problem. First, I found that removing the metal box from the radio stacking bracket (i.e., simply ungrounding it from the vehicle's frame) eliminated most of the noise. Interesting! Now, disconnecting the unused radios removed all the rest of the annoying whine. Even more interesting! It turns out that what I had done was to connect all of the grounds together inside the switchbox and then ground them to the metal switchbox itself, so that everything would be shielded from any source of noise. So much for that great idea! Instead, I now disconnected all the grounds from each other and from the box ground, and routed them through the rotary switch instead (fortunately, I had an extra set of contacts to do it). Now, none of the microphone cable grounds were connected to the switchbox or to each other any longer... and that turned out to be the final cure.

"Here's what was happening: As we all learned in basic electricity, electrons will take any and all paths available to them to get to wherever they are going. Now

amplified... along with any noise in the form of alternator whine. End of mystery!

"If you would like more exact details on how I connected everything up, or on where I found the parts to do it, etc., just send me an SASE (self-addressed, stamped envelope). I'll tell you all about it—perhaps more than you care to hear! I hope these tips and experiences prove helpful at some time to other 73 readers."

*Moderator's note: Interesting story, Gary—thanks for sharing it with us. Gary's experiences are a good lesson for all of us to keep in mind. It pays to watch for those sneaky multiple ground paths, especially where very low-level audio circuits are concerned. It also illustrates how every problem (hopefully) has a solution waiting to be found in a regimen of logical thinking and practical troubleshooting approaches. Sleeping on it often helps, too!*

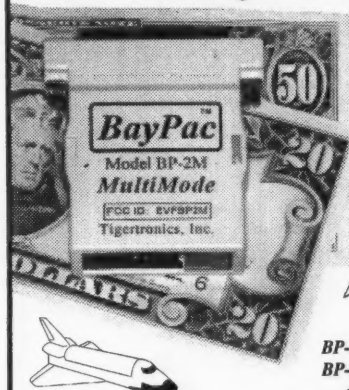
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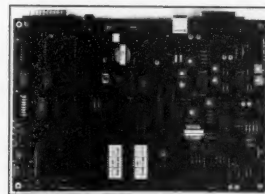
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on today's ham transceivers can sometimes make operation frustrating instead of the joy it should be. The reason for the intermittent pots can often be traced to the grease originally used to lubricate them becoming sticky and gummy with age and the effects of oxidation. This in turn causes the contact between the rotating wiper-arm and the resistance-film to suffer, making poor or even no contact at times.

"One cure is to stand the set up on its back, using thick padding or the original packing foam as a protective cushion, and then carefully remove the knobs from the offending controls. Using a syringe with a small-gauge needle, inject TCE degreaser down into the clearance spaces next to the concentric shafts of the pot or pots you wish to clean. Once the degreaser has penetrated, rotate the shafts back and forth a number of times to work the cleaner in and to loosen the gummy grease. When the pot has been thoroughly 'exercised,' inject a bit of GC Electronics deoxidizing cleaner or one of the other newer products that are now on the market. The GC Electronics material can be thinned with about 50% TCE to help it penetrate down into the tiny clearance areas between the pot's shafts if necessary. Caution: TCE is considered to be carcinogenic and should be used only in a well ventilated area, with tools and hands thoroughly cleaned afterward. Wearing disposable latex gloves will help to protect you even more effectively by preventing absorption into the pores of your hands.

"Once you've completed the procedure, turn the set back on and check for any further intermittent action in the cleaned pots, repeating the operation if needed. This is a good deal quicker and less costly than replacing the potentiometers, and should keep them working properly for a number of years to come."

**Moderator's note:** Pots on equipment used in a mobile environment may need this treatment even more frequently due to the rigors of heat, cold, and dust that are often present in a mobile installation. In fact, even fairly new rigs will exhibit very "stiff"

control action when the winter temperatures drop below zero in the northern areas of the country, often requiring this "de-gumming" sooner than home-based equipment. Radio Shack™ now sells several cleaning chemicals that can also be tried—some are "plastic-safe" as well as EPA-approved. Another brand worth looking at is made by Caig Laboratories of San Diego CA (800-224-4123 or 619-451-1799). It goes under their brand name of DeoxIT™. DeoxIT is a deoxidizing solution that cleans, preserves, lubricates and improves conductivity, all in one treatment. Using the procedure outlined by Rich, however, will pretty well assure you of getting the cleaner into the right spot—not everywhere else that you don't want it to be!

### Good labels

**From Phil Salas AD5X:** "For labeling front panels on my homebrew projects, I create a full-size

front-panel sheet on my computer with all the labeling neatly done, and then I print it out on a laser printer. I make the sheet slightly smaller than the front panel itself, then cover it with clear shelf paper lining... with enough overlap to hold it to the front panel. This clear shelf paper lining is very inexpensive. You can buy a large roll of it at most grocery stores, in the kitchen sundries section, for about \$3 or so. The switches, indicators, connectors, and so forth on the front panel itself will contribute to holding the sheet firmly in place. You could also apply some type of glue to the back of the paper, although I've not really found that to be necessary."

**Moderator's note:** 3M™ also makes a Scotch™ brand double-stick tape that may work in conjunction with Phil's suggestion: their No. 66 series tape, available in most office supply stores. It's a clear-film type that's adhesive on both sides, and small strips of it can be placed on the back of the areas where a wide expanse might otherwise result in buckling. I've also used the clear, self-adhesive

covering made by Contact™ as a protective film for panel labels and other paper surfaces that I've wanted to preserve from wear and tear. It can be found in most hardware and variety stores.

### Color me DEKA

**From George Primavera WA2RCB:** A tip for changing the hue of incandescent lamps used in radio LCD edge-lit displays, meters, dials, and many other places: "My Kenwood TM-241A 2-meter rig came with the standard edge-lit LCD display. The first thing I noticed was that the white incandescent edge-lit LCD was a bit distracting in the car at night, even with the dial dimmer turned down to the low back-light setting. What it needed was a coloration on the edge-lighting bulbs that was more night-vision friendly! A trip to our local art supply store netted a variety of colored (but still transparent) glass paint bottles under the 'DEKA' brand name (made by

upon temperature and humidity). Next, simply reinstall the bulb back into the radio from whence it came, reassemble everything, and turn it on. My TM-241A now sports a nice pumpkin-orange tint on its LCD, thanks to the newly colored backlight. It's noticeably less distracting while driving at night in a mostly darkened passenger compartment.

"A few precautions on this procedure should be mentioned: Do not color-tint any lamp larger in size than three watts, nor one that normally gets warmer than you would be able to touch safely while in operation. I've had no problems with the grain-of-wheat bulbs used in radios, or with #47 pilot lamps used as panel indicators, but automotive-type lamps (such as 1157) get much too hot. The paint will flake off from the excess heat in just a short time. Also, never apply this treatment to any kind of halogen lamp. Halogen bulbs must be meticulously free of any foreign substances on their glass or they can shatter violently! The colors that I've found to work best are #30—Light Blue, #27—Orange, #26—Lemon and #28—Light Red. Note that lamps treated with the #30—Light Blue color will have a reduction of about 60% in their visible light output.

"I'd recommend using this procedure on glass bulbs only if you try it on a 'throw-away' first. Plastic-encapsulated light devices, such as LEDs, might be chemically attacked by the solvent base of the glass paint."

### Recycled tubing

**From Bob Boehm N8EXF:** "The plastic tubing used in hospitals and nursing homes can often have applicability to our hobby! The rippled hose used for oxygen transfer to a patient can often be salvaged for use as a plastic conduit for running cables in your ham shack or perhaps in a mobile installation. The hosing can be used as is, or slit with a sharp knife along its length so that wires and cables can be tucked into it and given additional protection in harsh environments. Or maybe you can just keep those wires and cables a little neater-looking for appearance's sake..."

---

## "So much for that great idea!"

---

Decart USA, Inc., Lamoille Industrial Park, Box 309, Morrisville, VT 05661). DEKA is a color base 'paint' used by artists to paint pictures on glass, but I found that the 'paint' could also be useful for adding a nice color-tint to the miniature incandescent lamps used in my 2-meter rig.

"The procedure itself is very easy. First remove the bulb(s) that you want to color-tint, then grip them by their wire leads, using an alligator clip. With the leads pointing up, dip the bulb directly into the bottle of glass 'paint,' taking care to not get any paint on the wire leads themselves... the bulb should be dipped into the paint up to about 3/4 of its length.

"Now touch the tip of the bulb to a clean piece of metal once or twice to remove any excess paint from the bulb's tip-end, then wedge the alligator clip holding the bulb under some heavy object (miniature organizer drawers work well) to hold it in place. The bulb should be suspended in 'midair' and allowed to dry overnight (generally eight hours is the minimum drying time, depending

"Likewise, the smaller-diameter plastic tubing used for intravenous feeding, etc., makes great insulated, protective tubing for a number of ham and electronic applications. I use a length of it over my HF mobile whip antenna to act as a cushion between the whipping antenna radiator and the painted body of my van. The thick plastic tubing keeps the bouncing whip from marring the paint job on the back of my van very nicely. Generally, these hospital throw-aways are made of good-quality plastic material and should last for a number of years of exposure to the extremes of weather and friction. Give it a try."

*Moderator's note: I like Bob's idea. I saved some of the small tubing from my own hospital stay a number of years ago and have used it in numerous*

Bob Boehm N8EXF  
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Cincinnati OH 45230-2935

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## "Halogen bulbs must be clean, or they will shatter violently!"

applications since that time. The lengths are usually long enough to protect a vertically rising antenna wire from direct contact by the inquisitive fingers of neighborhood children (or paws of pets), and you surely can't beat the price! [That may be subject to debate.—Ed.]

Murphy's Corollary: Everyone has a foolproof scheme. It's easy to spot... it's usually the one that isn't working!

A very special thanks to this month's contributors:

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the column will be reimbursed by a contributor's fee of \$10, which includes its exclusive use by 73. We will attempt to respond to all legitimate contributors' ideas in a timely manner, but please be sure to send all specific questions on any particular tip to the originator of the idea, not to the column's moderator nor to 73.

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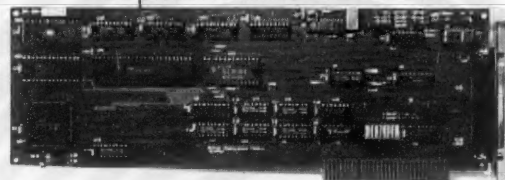
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# Communications Simplified, Part 17

Peter A. Stark K2OAW  
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## Optical Fibers

**A**s fiber optic cables fall in price, they are being used more and more for communications. In a nutshell, electrical signals are converted into a light beam (possibly visible, but more likely infrared) with an LED (light-emitting diode) or laser; the light beam is sent through a fiber made of glass or plastic; and then it's converted back into an electrical signal with a photodiode or phototransistor. Thus the fiber cable simply replaces the copper wire.

The optical fiber, however, has a number of features that make it superior for some applications. For one, its attenuation is much, much lower than that of cable, especially at high bandwidths. It is entirely practical to send high-speed data or analog signals some 30 to 40 miles without needing to amplify or regenerate signals along the way.

Optical fibers also offer immunity to electrical interference. They do not leak energy outward, are extremely difficult

to tap, and do not accept interference from other nearby signals. They are also immune to nearby lightning strikes, although this is sometimes compromised by cables that contain both optical fibers as well as electrical conductors inside the same cable.

Fiber optic cables can be made of either glass or plastic. A typical cable generally looks like **Fig. 1**, and consists of three parts:

**a.** The core is at the center. Made of very pure, clear glass or plastic, the core passes the light beam from one end of the fiber to the other.

**b.** The cladding is a second layer of glass or plastic, wrapped around the core. This layer is made of a slightly different glass or plastic, one that lets light travel just a bit faster than the core.

**c.** The jacket covers the outside of the fiber and protects it. In some fibers, additional jacket layers, including perhaps even metal sheathing, may provide additional protection.

To understand how this works, imagine that we are laying out an automobile

race course. In order to keep cars from straying off course, we construct it as shown in **Fig. 2**. In the middle is the race course itself, constructed of a very smooth surface designed for minimum friction. This is where we want each car to drive.

On each side of the racing lane we put a second lane made of a slightly different material, one which provides slightly better traction. This is labeled the speedup lane in the figure. Finally, at the very edge, just in case a car gets too far off course, we'll put a layer of sand to stop it so it can't wander back into the course and get in someone else's way.

So now look at car 1, which has somehow gotten slightly off course. As soon as it enters the speedup lane, the left wheels will have slightly better traction than the right wheels, so its left side will wind up traveling just a bit faster. This is going to turn it slightly to the right, so it goes back onto the racing lane. Car 2, on the other hand, is so far off course that it too will turn a bit to its right, but not

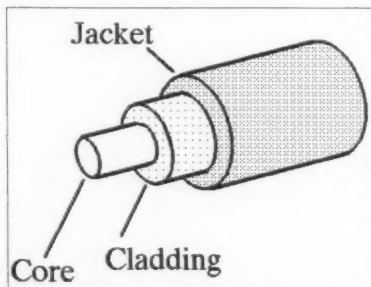


Fig. 1. Optical fiber construction.

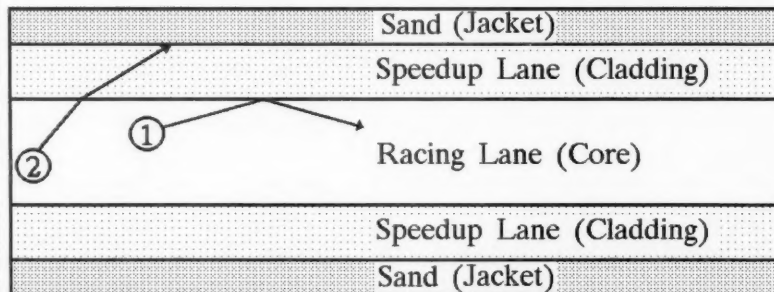


Fig. 2. Keeping a ray on track.



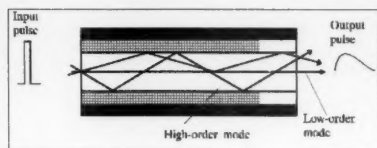


Fig. 3. Multi-mode fiber.

enough to return to the course. It will eventually get stuck in the sand, and that will keep it out of trouble.

Thus the speedup lane keeps the cars from straying off course, without any intervention on their part. You could almost put a blindfolded driver into a car, and the course itself would keep him on track.

The optical fiber works exactly the same way. The cladding is made from a glass that lets light travel just a bit faster than the core. In terms of physics, the core has a slightly higher index of refraction than the cladding; this makes light travel slightly more slowly in the core than in the cladding. When a ray of light tries to leave the core and enter the cladding, it is bent back just enough to reenter the core. If it's like car 1, it returns to the core and keeps going. But if it's like car 2, then it goes right through the cladding until it hits the jacket, and gets stopped.

It is important to realize that the process of "bouncing" off the cladding back into the core is not the same as reflection off a mirror. Reflection in a mirror always loses a small amount, since no mirror is perfect. Refraction, as it is called, is 100% efficient—there is no light lost in the process. The only light that is lost is due to any impurities in the glass.

Fiber optic cables can actually be made from either glass or plastic. As such, they come in three types:

- All glass is best, and most expensive.
- All plastic is worst, but cheapest.
- Plastic-clad silica (PCS) is a compromise, where the core is quartz-like form of glass called silica, but the cladding is plastic.

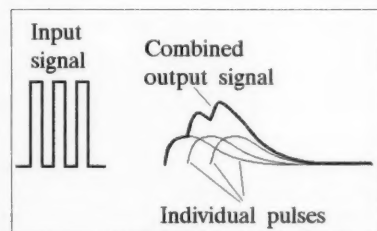


Fig. 4. Dispersion spreads pulses.

The difference is primarily due to the fact that glass is clearer, and therefore significantly more light gets through the fiber. Because of the loss of light, plastic fibers are only usable in short lengths of a few hundred feet, whereas glass fibers can be dozens of miles long.

### Transmission modes

Referring to Fig. 2, we can see that a car which goes straight down the core will make better time than a car which constantly bounces from edge to edge. This is an extremely important concept in optical fibers as well, because it determines the dispersion of light.

Fig. 3 shows a stepped-index or multi-mode fiber. It is called stepped-index because there is a sudden change (mathematicians call it a step) in the index between the core and the cladding; it is called multi-mode because it permits many modes. The mode describes the path that a light beam takes: a low-order mode is one that goes directly through, taking as few bounces as possible. A high-order mode is one that takes many bounces before arriving at the far end. Obviously, a high-order mode light ray must travel a greater distance to the far end, and so arrives later than a low-order light ray. If the light is pulsed on and off, as shown at the left, the pulse arrives at the far end spread out, as shown at the right. The term dispersion describes how spread out the pulse is at the output.

The amount of dispersion depends on the length of the fiber. When a fiber is short, the difference between a low-order path and a high-order path is fairly small, so the total dispersion is fairly small as well. The longer the fiber, the greater the difference in path length, and therefore the greater the dispersion.

Fig. 4 shows why dispersion is a problem. Most fiber optic cables are used for digital signals; the bandwidth of such a cable depends on how many pulses can be sent per second. When a fast series of such pulses is sent through the cable, dispersion spreads out each pulse as shown. The pulses then overlap, making it harder to properly separate and detect them. When dispersion makes adjacent pulses blend together too much, the only solution is to separate the pulses farther

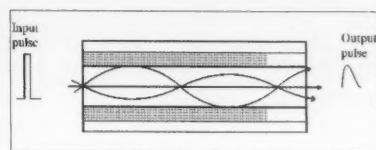


Fig. 5. Graded-index fiber.

apart. This limits the number of pulses that can be sent per second. In other words, the bandwidth of the fiber depends on its dispersion, which in turn depends on its length—the greater the length, the lower the bandwidth.

A graded-index fiber (Fig. 5) is a partial solution to the problem. Rather than having a sudden change in the index of refraction between the core and the cladding, the graded-index fiber has a gradual change in the index. This has two effects. First, it results in the light rays gradually bending back toward the middle, rather than abruptly "bouncing" back and forth. This tends to gradually straighten out the light path, causing more of the rays to travel along low-order modes rather than high-order paths. A more important effect is caused by the fact that the index of refraction is highest in the middle of the fiber, and gradually decreases as you go outward. Light rays traveling toward the edges of the fiber therefore move faster than those in the middle. Even though they travel a longer distance, the faster speed lets them catch up with the lower mode rays in the center. The result is less dispersion.

The best solution to the dispersion problem is with a single-mode fiber; a fiber which has only a single possible mode of light transmission. Just as two out-of-phase electrical signals can cancel, so two out-of-phase light rays can cancel. Because of this interference effect, there are only certain specific light paths (modes) in a fiber which are possible; all others cancel out because of interference. If the core is made thin enough, the only mode that is possible is the one straight-through mode in the middle. The resulting single-mode fiber, shown in Fig. 6, thus has much less dispersion and therefore a higher bandwidth.

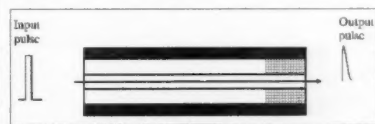


Fig. 6. Single-mode fiber.

You can understand, though, that a very thin single-mode fiber will let through much less light than a thicker multi-mode or graded-index fiber. For that reason, single-mode fiber generally requires a glass core which, because of its clarity, attenuates the light less. Plastic fibers, on the other hand, are usually thicker to let through more light. This increases dispersion and thus reduces their bandwidth, but this is not much of a problem because their attenuation is so high that they can only be used in shorter lengths; at these lengths, dispersion is not as bad as it would be in very long lengths.

### Fiber characteristics

Let us next look at some characteristics of actual fibers of various kinds, listed in **Table 1**.

### Core and cladding diameter

Fiber diameters are given in  $\mu\text{m}$  or micrometers— $10^{-6}$  meters. To put this into context, note that a typical human hair is about  $50 \mu\text{m}$  thick, so the thinnest fibers are about 1/10 of the thickness of a hair. Fiber dimensions are usually stated as two numbers separated by a slash; that is, a 50/125 fiber has a  $50\text{-}\mu\text{m}$  core diameter and a  $125\text{-}\mu\text{m}$  cladding diameter.

In general, the plastic fibers are much thicker than the glass fibers, although multi-mode glass fibers can

also be quite thick. The thinner fibers obviously must be much clearer to let through enough light.

### Attenuation

The attenuation determines how long a cable can be used before the signal becomes too small to be useful. It is rated in dB of signal loss per kilometer of length. The best glass fibers have losses below 0.5 dB per kilometer, whereas some of the plastic fibers have losses of as much as 400 dB per km.

The best glass fibers are amazingly clear—a 6-km length of glass single-mode fiber, about 4 miles, would have a loss of about 3 dB. To realize just how amazing this is, think of a piece of window glass 4 miles thick. With ordinary glass, you probably would not even be able to detect light through it. With a fiber, a 3-dB loss means that half of the light entering it comes out the far side!

Even with 30-mile lengths (about 50 km) of a good glass fiber, the loss is only some 20 or so dB—a loss of 99% of the light power, but still within a reasonable range. Plastic fibers, on the other hand, can have huge losses. At 400 dB per km, 20-dB loss would occur in about 1/20 km, or about 150 feet. Because of this high loss, the maximum usable length of a plastic fiber is a few hundred feet—long enough to go within a small building, but not much more.

It is interesting to compare fiber attenuation with the attenuation in copper cables. The attenuation of copper cables increases with the frequency of the signal. For example, good quality RG-8 with a foam dielectric has about 1.2 dB loss per 100 feet at 50 MHz, about 2 dB loss at 150 MHz, and 3 dB loss at about 300 MHz.

Let's look only at the loss at 50 MHz, since that is close to the 47.736 MHz data rate of a T3 line, a common data speed in optical fibers. Since there are about 3300 feet in a kilometer, a 1-km length of RG-8 would have about 40-dB loss at 50 MHz. Even one of the best and most expensive coax cables (7/8-inch-diameter hardline) would have a loss of 12 dB per km at 50 MHz. Compare this with the 0.5 dB per kilometer loss of a good glass optical fiber, and you can clearly see the advantages of fibers over long distances.

### Attenuation vs. frequency

As we just mentioned, the attenuation in copper cables depends greatly on the frequency, and therefore affects the bandwidth. As the frequency increases, the attenuation goes up very fast, and this greatly limits the bandwidth.

When talking about fiber cables, however, we must be careful, because there are two frequencies to consider—the frequency of the light (which actually describes the light's color), and the frequency of the data (which describes how fast the light is turned on and off in the case of digital data, or how fast its intensity changes in the case of analog data). Rather than use frequency, however, physicists use the wavelength since it is easier to measure (as you remember, the wavelength is the velocity divided by the frequency, so it is easy to convert back and forth). The wavelength is measured in nanometers or nm (one nm is  $10^{-9}$  meters), and the colors measure approximately as follows:

- Ultraviolet: shorter than 400 nm
- Violet: 400-450 nm
- Blue: 450-500 nm
- Green: 500-570 nm
- Yellow: 570-590 nm
- Orange: 590-610 nm
- Red: 610-750 nm

Type	Core Diameter ( $\mu\text{m}$ )	Cladding Diameter ( $\mu\text{m}$ )	Attenuation (dB/km)	BW MHz•km	NA
Single mode glass	5	125	0.5	1000+	small
	8	125	0.4	1000+	small
Graded index glass	50	125	4	400	.20
	63	125	7	250	.29
	85	125	6	200	.26
	100	140	5	20	.30
Multimode glass	200	380	6	25	.27
	300	440	6	20	.27
Multimode PCS	200	550	10	15	.30
	800	900	6	20	.30
Multimode plastic	980	1000	400	20	.50

**Table 1.** Optical fiber characteristics.

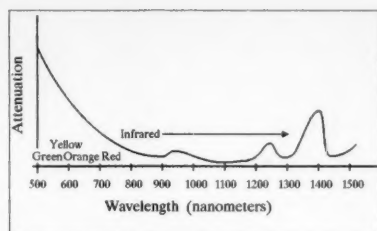


Fig. 7. Attenuation of glass fiber.

•Infrared: from about 750 to about 1400 nm

(Ultraviolet and infrared wavelengths are also considered to be light, but they are invisible to the eye.)

Light's wavelengths are so short that they are greatly affected by molecular and atomic characteristics of materials. For example, Fig. 7 shows the attenuation of glass at various wavelengths. We see that the attenuation varies quite a bit with wavelength. At very short wavelengths (toward the left of the graph), light transmission is affected by individual atoms—the farther left you go, the greater the attenuation, so these wavelengths are not very useful for optical fibers. At longer wavelengths (toward the right), light transmission is affected by certain combinations of atoms, and so there are specific wavelengths that are highly attenuated, while other nearby wavelengths get through with relative ease. As long as we stay away from these attenuation peaks, the red and infrared wavelengths will work best.

This is fortunate, because LEDs and diode lasers are easier to build, more efficient, and cheaper at infrared and deep red colors. Glass fibers are generally used with infrared light between 790 and 1300 nm because that is where the attenuation is least. Plastic fibers, on the other hand, are usually used with red light at about 650 nm.

Note that it is possible to send several different colors through a fiber cable at the same time, as long as we choose the colors wisely. Thus it is possible to send two or more different signals through the cable. Still, this is not too common in longer cables, because feeding two or more color sources into the same fiber, and then separating them again with colored filters, introduces losses that limit the distance.

The attenuation of various colors is thus a separate topic from the concept of signal bandwidth.

### Signal bandwidth

The bandwidth of a fiber is related to how fast we can turn a beam on and off, or more likely, how fast we can change its brightness (because even in digital applications, the beam is usually switched between bright and dim, rather than between bright and off).

This speed is determined by two factors: the speed at which the light sources and detectors can work, and the dispersion in the fiber itself.

As we showed in Fig. 4, dispersion makes adjacent pulses blend together; they therefore have to be separated farther apart.

Since the dispersion increases with the length of a fiber, the pulse rate for a given fiber is inversely proportional to the distance. If the length (in km) is large, the frequency at which we can switch the beam (in MHz) is small, and vice versa. The product of these two quantities is therefore fairly constant for a given fiber, and is given in "MHz times km" or MHz•km. This number is listed in the bandwidth column of Table 1.

For example, the bandwidth for single-mode glass fiber is shown as 1000+ MHz•km (the + means that it is 1000 or greater). Assuming a value of an even 1000, a 1-km length of fiber would have a bandwidth of 1000 MHz; a 10-km length would work up to 100 MHz; and so on.

Compared with 1000+, the rating of 20 MHz•km for multi-mode plastic fiber looks awful... until we put it into context. Remember that, because of its attenuation, plastic fiber is limited to a small fraction of a kilometer. For instance, consider a plastic fiber 1/20 km long; at that length, the bandwidth is still a respectable 400 MHz (since 400 MHz times 1/20 km is 20 MHz•km). Thus plastic fiber can also be used for high bandwidths, but clearly only for short distances.

This helps to explain why no one bothers to make single-mode plastic fibers—there is simply no way to take advantage of the lower dispersion that this would provide.

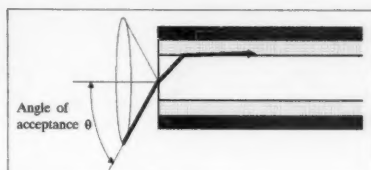


Fig. 8. Numerical aperture with cone of acceptance.

### NA or numerical aperture

The last column in Table 1 shows the numerical aperture for various fibers. The meaning of this measurement is shown in Fig. 8.

The dark line at the left in the figure shows a light ray which comes into the fiber at such a steep angle that it hits the cladding and stays there; it does not "bounce" off it back into the core. Clearly such a light ray is not going to make it to the far end. Furthermore, any other light ray that is at that angle or more will not make it through either.

The result is that there is what we call an *angle of acceptance*  $q$ , which defines the cone shown in Fig. 8. Light coming in within that cone will be transmitted through the cable; light coming outside that cone will not. The light coming out the far end of a fiber will generally come out in a cone of the same angle, though in some cases the higher-order light modes can be attenuated in a longer fiber, with the result that the light comes out in a narrower cone.

The numerical aperture NA is simply the sine of the angle  $q$ , namely

$$\text{numerical aperture NA} = \sin q$$

From Table 1, we see that the NA is between 0.2 and 0.3 for most of the fibers shown, corresponding to angles  $q$  of 12 to 18 degrees. Multi-mode plastic fiber's NA of 0.5 corresponds to 30 degrees, while single-mode glass fiber has acceptance angles of less than 10 degrees.

The NA is important when matching a fiber to the light source or light detector, or when connecting two fibers together. For example, a plain light bulb would be a very bad light source for a fiber, since its light comes from a large area, most of which would be outside the angle of acceptance.



# 2m Self-Supporting Delta Loop

*So simple—and perfect for apartment dwellers.*

Thomas M. Hart AD1B  
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Dedham MA 02026

While sitting on the couch, reading the newspaper, and listening to some local 2m repeaters on my handie-talkie, I decided my signal needed some additional punch. The handie-talkie with three-inch antenna was not producing anything near the desired "dead full quieting" on certain local machines when it was my turn to comment. Buy an amp? Resurrect that 5/8-wavelength whip? Both of these were unalluring prospects for reasons of cost and ergonomics. My thoughts turned to something different.

**Photo A** shows a full-wave delta loop for 2m that can be deployed when needed or folded up and stored at other times. The loop is self-supporting, fed with 50-ohm coax, and offers an excellent SWR. The woodworking tools required are simple; tune up is easy; and it travels well. The design is for vertical polarization, the norm on 2m FM work.

The materials for the frame include a 12-inch-wide pine board, two 36-inch dowels of 1/2-inch diameter, a bolt with wing nut, and a spring-loaded clothespin. The wire used in the element is Radio Shack™ hookup wire fed by an SO-239 fitting. An appropriate length of coax is used to connect to the rig.

My only test instrument was a Radio Shack 2m SWR meter. The final tune-up assembly eliminates the traditional "cut, cut, cut, oops—too short" method in favor

of a nut and bolt slider. When complete and sitting in the middle of the room, the antenna performs remarkably well. Further, it is less expensive and cumbersome than either of the initially considered alternatives.

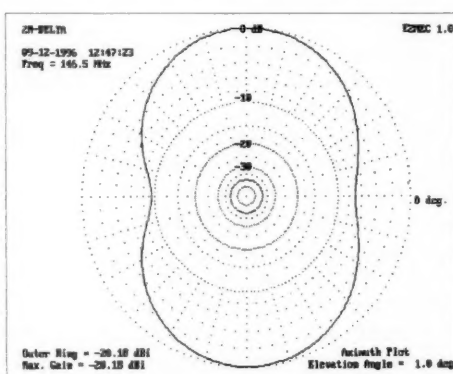
Construction was easy (see **Fig. 1**). I cut a 12-inch-diameter circle from the pine board and drilled a hole in the center. Careful filing produced a tight fit for the 36-inch dowel that supports the antenna. A second dowel, 28 inches long, was cut for the horizontal element. Then, it was time to rough cut the wire and start final tuneup.

The formula for a loop on high frequency antennas was used as a starting point:  $\text{Length} = 1005/F(\text{MHz}) = 1005/146.5 = 6.86$  feet of wire.

I cut a seven-foot length of hookup wire and soldered one end to the center connection of the SO-239 connector. A short length of wire with a screw and nut on the end was bolted to the ground side of the socket. This acts as a fine-tuning device.

The loop and frame were then taped together in a rough approximation of the final shape. A period of cutting and SWR measurement brought the loop close to final length. A section of insulation was removed from the end of the loop and final adjustment was made by sliding it through the nut and bolt assembly. When the SWR

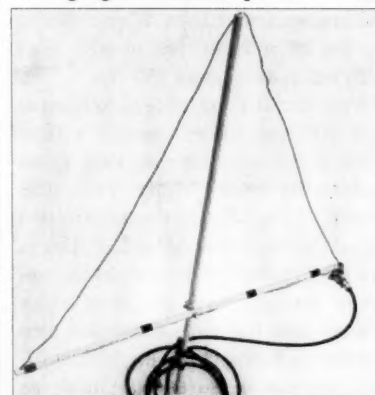
registered 1:1, I tightened the tuning assembly and used a bolt and wing nut to hold the frame together. Another bolt fastened the SO-239 to the end of the horizontal element, and a spring-loaded clothespin was attached to the vertical dowel to provide strain relief for the coax. The final step was to retune the loop because the SWR changed slightly



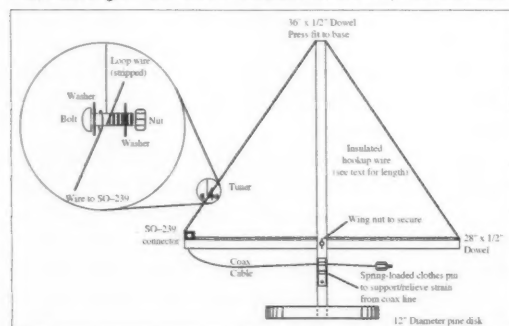
**Fig. 2.** Software analysis. Azimuth plot of field strength by Ezmecc software program. Gain is shown perpendicular to plane of loop.

after the addition of hardware and final shaping.

The loop has worked very nicely for me. I stand it in the middle of the floor and have no trouble working all I can reasonably hear. Recently, it was interesting to pick up a signal from a repeater located on Long Island. By rotating the loop, I was able to bring the signal up to a very reasonable level. I could not work that repeater because the local machine would come on and cover up Long Island. I was impressed by the directivity of a single loop, however. This self-supporting loop has worked very well and is a simple alternative to running higher transmitter power. 73



**Photo A.** 2m self-supporting delta loop.



**Fig. 1.** Construction details.

# Home-Brew Transistor/Diode Tester

*Not just blinking lights and weird noises.*

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**A**lthough I'm not a radio amateur, I enjoy reading each new issue of *73 Amateur Radio Today*. Unlike other electronic magazines, which offer construction projects with silly blinking lights and weird noises, *73* provides useful projects that are well

worth the time and effort to build. I built J. Frank Brumbaugh's Capacity Meter (March 1996) and have found it to be one of my most useful test sets.

I have always needed a better method to identify and test transistors, but I didn't want to invest a lot of money in

commercial test equipment. I decided to build my own tester. The test set described here is designed for out-of-circuit testing, uses two ICs (only 1 if you use the dual 556 timer), and can be built in an afternoon. It will automatically identify transistors for NPN or PNP type

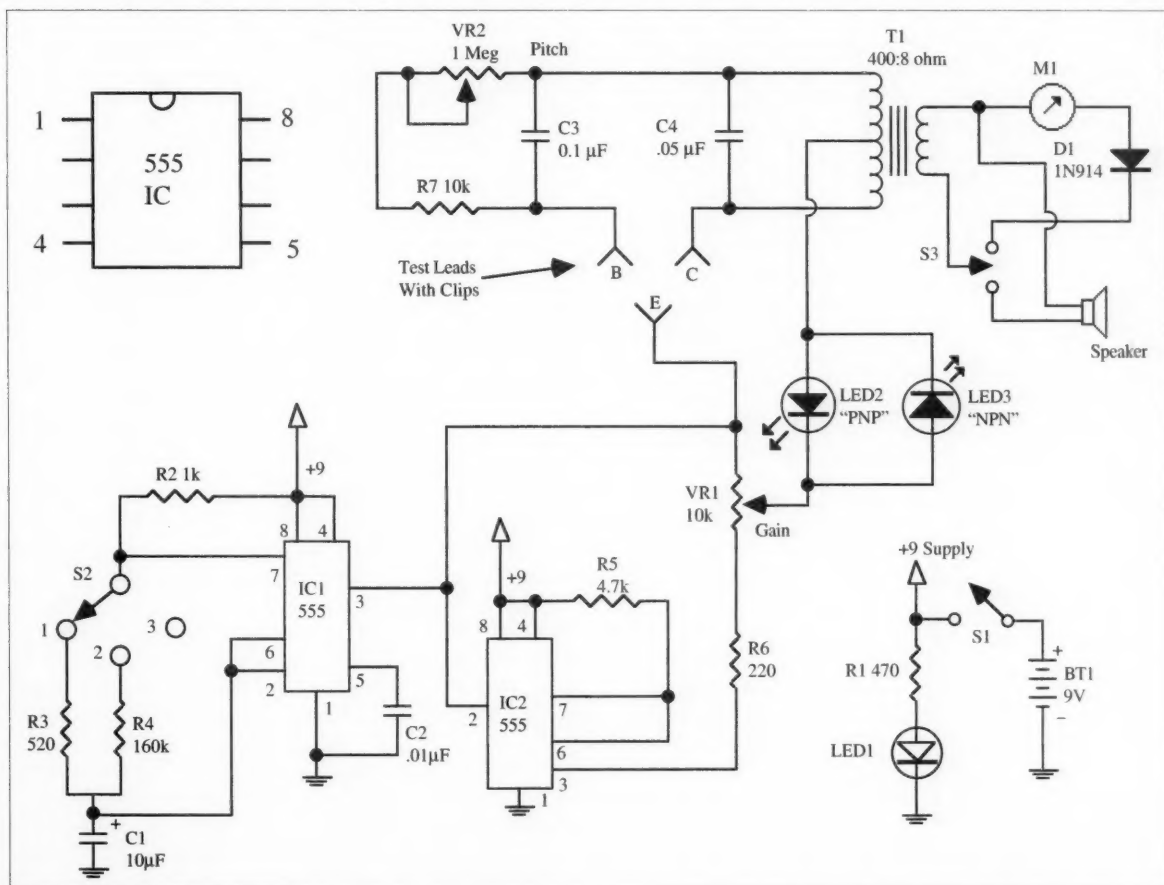


Fig. 1. The transistor/diode test set schematic. S2 positions: (1) diode test; (2) transistor test/identify; (3) freeze last pulse.

as well as give you a relative indication of gain. In audio mode, unmarked transistor leads can be identified. Diodes also can be checked for shorts, opens and polarity.

### Circuit description

**Fig. 1** provides the schematic diagram of the transistor tester set. IC1 and IC2 are both 555 timers and their outputs are capable of sourcing or sinking up to 150 milliamps of current. IC1 is connected as an astable multivibrator and the output clock rate is dependent upon the values of C1, R2 and the setting of selector switch S2. The output clock from IC1 is connected to the trigger input of IC2 and also connected to one side of variable rheostat VR1. IC2 is wired as an inverter and simply provides a complementary output, of IC1, to the other side of VR1. When the selector switch is in position 1 or 2, the DC voltage on the two 555 timer output pins is continually reversing in polarity and similar to a flip-flop in operation. When the selector switch is moved to position 3, the RC network of IC1 is disconnected so that the last output voltage pulse remains constant.

The wiper arm of VR1 provides an adjustable voltage, in series with LED1 and LED2, to an oscillator circuit, which depends upon the transistor under test for oscillation. If a known good NPN transistor is correctly connected to leads E, B and C and the selector switch is set for position 2, the NPN LED should light for approximately one second, remain off for one second and repeat the cycle. During the pulse period that the LED is lit, the transistor will oscillate as indicated by a tone from the speaker or an output indication on the meter, depending upon the setting of switch S3. If the NPN LED lights on one pulse and the PNP LED lights on the next pulse, then the transistor should be considered faulty. R6 provides current limiting to the LEDs, if a shorted transistor were inserted. VR2 provides tone pitch control and also has an effect on transistor gain.

### Circuit construction

I built the circuit on perfboard using two 8-pin wirewrap IC sockets to mount the 555 timers. If a low wattage soldering iron is used, wiring can be soldered directly to the IC pins, eliminating the

use of sockets. All resistors, capacitors, transformer T1 and the 9-volt battery were mounted on the perfboard; the remainder of the components were mounted on the faceplate. Parts locations are not critical. For the test set faceplate, I cut out a five-by-seven-inch panel from scrap aluminum and drilled out holes for the pots, switches, meter, LEDs and test leads. Four 1/8-inch holes were drilled in the midsection to allow audio from the speaker. The aluminum panel just fit a small metal enclosure I had in my junk box. A plastic cabinet with aluminum faceplate is available from Radio Shack™ and gives any homemade test set a professional look. I used color-coded clip-on test leads for the emitter, base and collector connections. These leads have alligator clips on both ends and are also available from Radio Shack. I cut the clips off at one end and soldered the cut ends to the proper components on the perfboard and faceplate, then installed a rubber grommet in the faceplate hole for the test leads, and then ran all three leads through the same hole. I placed a small nylon cable tie around the test leads on the inner side of the faceplate for strain relief; you may prefer to use a larger faceplate and mount several types of transistor sockets, wired in parallel, to provide test connections.

I salvaged the meter from a discarded stereo amplifier, but any 150-200 microamp meter should work nicely. I have also had good luck with 50 microvolt full-scale meters for audio level use. The 50-microvolt meter is intended to be paralleled with a high-current shunt bar, and telephone companies usually replace these meters when increasing their power distribution capacity. If you know someone who works with telephone switching equipment, they may donate one that was removed from their power boards after an upgrade. If you are unable to locate a 3-position selector switch, you can use an SPDT switch to change the pulse rate, and add an SPST switch in series, between C1 and pins 6 and 2 of IC1, to open the RC network and stop the pulse.

The LED indicators LED2 and LED3 should be capable of 50 milliamps of forward current in case a shorted transistor is connected for testing. If you intend to use LEDs found in your junk box, and are unsure of their current capacity, be

sure to use red, instead of yellow or green, because they are usually (but not always) rated for higher current. During normal operation, with a transistor connected for test, the total test set current drain is approximately 30 milliamps.

### Testing

After assembly is completed and the test set is connected to a 9-volt battery, place the selector switch in position 2 and turn power switch S1 on. LED1 should light, indicating power has been turned on. Using an analog voltmeter, place the voltmeter leads across the collector and emitter test leads. With the gain potentiometer (VR1) turned fully clockwise (all resistance out), you should see the voltmeter indicate approximately 6 volts for a second, then a polarity reversal during the next second, then the cycle repeated over again. If no voltage is observed, move the voltmeter black lead to ground (negative) and connect the red lead to pin 3 of IC1. If a pulsing voltage is observed, move to pin 3 of IC2 and also check for voltage. Recheck all wiring and replace ICs if necessary. After the problem is located and corrected, return to the collector and emitter test points and recheck for alternating voltage. Change the selector switch S2 to position 3. The voltage should remain constant from the last pulse, and you may have to reverse your meter leads to verify. Change the selector switch S2 to position 1 and verify that collector-emitter voltage drops to approximately 2-3 volts. This is because of the rapid reversals (100 cps) that are occurring; the meter is only providing an average reading.

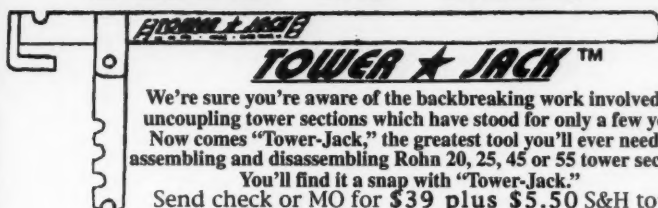
### Operation

Connect a known good NPN- or PNP-type transistor to the three test leads, turn switch S1 to position 2 and turn on the power. The LED indicating the correct transistor type should light for approximately 1-second intervals and the second LED should remain unlit. If switch S3 is in the "audio" position, an audible tone should be heard from the speaker each time the LED lights. To "freeze" the pulse, switch S2 to position 3 just as the LED lights. Adjusting VR2 will change the pitch of the tone and also have an effect on gain. Throw switch S3



Parts List	
IC1, IC2	NE555 IC timer or NTE955M
(2) 8-pin IC socket*	
R1	470Ω 1/2W
R2	1000Ω 1/4W
R3	520Ω 1/4W
R4	160k 1/4W
R5	4.7k 1/4W
R6	220Ω 1/2W
R7	10k 1/4W
VR1	10k variable rheostat linear taper
VR2	1 megohm variable rheostat linear taper
S1	SPST toggle switch
S2	3-position rotary switch
S3	SPDT toggle switch
C1	10μF 16V electrolytic
C2	.01μF disc ceramic
C3	0.1μF disc ceramic
C4	.05μF disc ceramic
T1	Audio transformer 400VCT: 8Ω*
M1	Meter 150-200μA
8Ω mini-type speaker	
LED 1, 2, 3	NTE3007 or equivalent
D1	Diode 1N914
(3) Test leads w/alligator clips	
BT1	9V battery
Snap-on connector for battery	
Case*	
Perfboard*	
(3) Pointer-type knobs	
* Available at Radio Shack®	

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from audio to meter. The meter should indicate an output level when the LED lights. If the meter that you used pegs out with every transistor tested, you may have to install a 50k potentiometer in series with the meter to adjust sensitivity. It would be a good idea to check both NPN- and PNP-type transistors before continuing. To check a diode, simply connect the emitter and collector test leads to the diode and switch S2 to position 1. A good diode will light only 1 LED, while a shorted one will light both. Neither LED will light if the diode is open.

### Going further

Experimenting with different types of transistors will quickly get you familiar with the test set. You can rapidly sort transistors for types and discard defective ones found in your junk box. You will be able to identify leads on unmarked transistors because the transistor will only oscillate when properly connected. I noticed that some horizontal output power transistors caused both LEDs to light during testing, even though they would oscillate and provide a good output on the meter. After checking the specifications for these transistors, I found that they were manufactured with an internal damping diode which made the transistor appear to be shorted!

You might want to consider adding a milliammeter in series with the collector test lead to measure the current of the transistor under test. To maintain the correct current polarity to the meter will require installing a bridge rectifier circuit in series with

the collector and inserting the milliammeter in the center of the bridge. The bridge diodes will route the current in the same direction through the meter regardless of whether an NPN or PNP transistor is being tested. The diode bridge will cause an additional voltage drop of approximately 1.4 volts and this will affect the gain of the test set. In order to compensate for this, you may want to increase the power supply voltage to 12 volts. The 555 timers can safely handle the voltage increase. Do not use a 12-volt supply unless you intend to add resistance of some type in the collector-emitter test circuitry to compensate. The higher voltage can cause the transistor, under test, to break down with reversed voltage (avalanche current) and both LEDs will light providing a false indication that the transistor is shorted.

Another alternative, to measure current, is to add a 100-ohm resistor in series with the collector lead and use the measured voltage drop across this resistor to calculate the current. For example, if the measured voltage across the resistor is 1.5 volts, then use Ohm's law to determine the current:  $I = E/R$  or  $1.5 \text{ volts}/100 \text{ ohms} = .015 \text{ amp}$  or 15 milliamps. The base current can also be calculated by measuring the voltage drop across the 10k resistor R7. The Hfe, or gain, of the transistor can be calculated by the formula  $Hfe = Ic/Ib$  where  $Ic$  equals collector current and  $Ib$  equals base current.

I hope that this transistor/diode test set proves to be a valuable part of your test gear. If you find a modification that enhances it, I'd like to hear from you!

# RTTY LOOP

## Amateur Radio Teletype

Marc I. Leavey, M.D., WA3AJR  
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Stevenson MD 21153

Well, about all that comes to mind is that wonderful old song which goes, "Though April showers may come your way / they bring the flowers that bloom in May." While we have had our share of precipitation here in the mid-Atlantic states, blooming here at WA3AJR are your questions, and what questions they are! This month brings a pack of real problems.

I'll start with one from Wayne Grove K9SLQ, who writes that he recently uncovered his Model 28 in the garage, picked up a tape recorder and TU, fired the sucker up and enjoyed the sounds again from the ol' 28. Well, his question is, "Where can I find some of the old PIX we used to send in file form? I combed your articles but could not find any mention of the PIX in the 'Good Ol' Days'."

Well, Wayne, several years ago I ran an entire feature on TTY pictures, some of them quite complicated. In fact, it seems to me that for some years there was a competition on the air to see who could come up with the most creative picture. Some of them were very creative, indeed! Unfortunately, with the onslaught of computer terminals, many of which sported a different line length than teleprinters, and few of which could back scroll to view transmitted pictures, it seems to have gone out of vogue. I have asked several times here in the column for submissions, and have received none. So, unless you happen to run across someone with a good collection of old paper tapes, I am afraid that this may well be one area where the computer is just not as much fun as an old mechanical printer.

With the recent demise of AEA, as reported in this column a bit ago, we are beginning to see more unanswered questions about some of their products.

Such a question comes from Chris Cieslak AA9HD, who writes: "I've been using RTTY now since last summer, starting with the HamComm circuit and recently graduating to a used PK-232 bought at the local hamfest. (The first time I used it after replacing a few parts and cleaning it up was the RTTY Roundup—talk about trial by fire!) I have one question: Do you know of any homebrewable scope-style tuning circuits for the PK-232, which has outputs on the back for a scope? The tuning indicator on the front is nice, but I've always liked the cross displayed on a scope. I know I could use an old hamfest scope, but my limited shack space and sense of aesthetics requires something a bit smaller."

Well, Chris, I'm afraid that the short answer is "no." I have seen a few circuits in the past for LED-type display boards, but these were years ago, and relatively clumsy by today's standards. I would not be surprised, though, if some reader of this column has not already put together such a device. If I hear about it, I'll print it for all to benefit.

Another AEA user, Ron Modeste N3AHD, bought an AEA CP-1 at a local hamfest, and is looking for a way to copy RTTY or CW with an IBM-style computer with this device, designed for the C-64. Well, Ron, while I have printed a lot on the CP-1 over the years, never has anyone written with a connection scheme for the PC. Somehow, I feel this is possible, but not having access to a CP-1 nor full documentation, I am loath to suggest a way. If any of our readers have done it, I'm sure we will both hear about it, real soon!

Not satisfied with one question, Chris Cieslak AA9HD adds:

"Oh, OK. One more question. Have you heard anything about using the ICOM 728 for RTTY? I've been using it full power for a while and while it's gotten quite warm, it wasn't hot enough to burn or anything. The manual mentions nothing pro or con on keydown RTTY. QST says the radio was barely warm after several minutes of keydown full power, but what about repeated use? I love RTTY and operate it more than anything else (except maybe SSTV) so I'd hate to have to turn the power down."

While I have not heard any specific information about the ICOM 728, in general, most modern rigs should not be run wide open, key down, for any length of time. I hear you about getting only barely warm, but that's on the outside. Who knows how warm it is at the component level? I'd play it a bit safer and back the power down a notch. After all, in the scheme of things it may only be a decibel or so difference on the air, versus a decade or so life of the equipment. I'm open, of course, for comments on this one, as well!


Ford A. Peterson NØQW writes that he is looking for software to run his HAL Communications ST-6000. He indicates that an old program, HAMRTTY, worked well, whereas the newer Hamcomm program does not compare. He wonders which of the newer crop can use all of the features of the ST-6000.

Well, Ford, my experience with HAL devices ended with the ST-6, I'm afraid. [...Why are you afraid, Dave?] I do recall that the ST-6000 had some gizmos that took it head and shoulders above other demodulators of its time, but although I looked through some of the packages in the RTTY Loop Software Collection, I did not see any which specifically mentioned the ST-6000. I would be interested in any reader's experience with this TU in modern systems.

Of course, things can get too modern! A while back we were talking about using various sound cards on RTTY, and Tom Petruzzelli WA2ANG is "still looking for any programs that use the Soundblaster card for sending or receiving RTTY and/or CW. Do you know of any software either commercial, freeware or shareware?"

Well, Tom, while I was not able to find any RTTY program for the Soundblaster card, I have located a program called SSTVBL.ZIP, which allows slow scan television with a computer, Quick-Cam camera, and Soundblaster card. I've also found a program called SBPMORSE.ZIP which is a Morse code reader using the microphone input of the Soundblaster card. I don't know if these will run with "compatible" sound cards, as they both list the Soundblaster by name as the audio card of choice. I will be putting both of these programs onto a disk in the RTTY Loop Software Collection. See details below for how you can obtain any or all of these programs for yourself.

While some of the folks mentioned above have been trying to get C-64 hardware, like the CP-1, to run with PCs, Jerry Olson WBØAAC says that he is looking for software to interface his Commodore C-64 computer with the Kantronics UTU demodulator, for running RTTY, AMTOR, or CW. Again, I can't see why it shouldn't work, if the connections can be put together. Anybody?

I have mentioned the RTTY Loop Software Collection above. The listing of this collection, over fifteen disks of RTTY programs for DOS and Windows operating systems, is detailed on the RTTY Loop Home Page, on the Web at: <http://www2.ari.net/ajr/rtty/> or you may obtain it by sending a self-addressed, stamped envelope to the above address. Next month, I have a new offering from overseas, which represents a unique merger of two ends of this crazy hobby. Intrigued? Don't miss next month's RTTY Loop! 

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### Modifications to the MFJ-259/219 SWR Analyzers

I just hate to turn on a piece of test equipment and find the batteries dead. I would rather have the batteries discharged and recharge them than have to purchase a replacement set of alkaline batteries. Considering the current price for alkalines and the cost of NiCds, the latter become very attractive—especially after you purchase your second set of the former. The trick here, though, is that the battery connector on the MFJ-259 SWR analyzer is for an external battery. When an external battery is connected, it disconnects the internal alkaline pack.

I had to modify this operation so that I could use external batteries if I wanted to, as well as charge an internal NiCd pack. These modifications were to be made in such a manner that the MFJ-259 was protected from reverse voltage and its basic operation not affected. The problem here was that the original connector, when hooked to an external battery, cut off the ground connection to the original internal battery pack. When installing NiCds, avoid this by shunting around the switch with the current-limiting resistor.

Several cautionary notes need to be observed when making a modification like this. The paramount thing is to make the external connection *idiotproof*. Make the modification impervious to reverse-connected DC power. Wrong polarity connected, nothing happens—a great insurance policy that provides a great deal of protection for the cost of a small diode rectifier like a 1N4002.

The last thing you would want is to connect power and destroy this SWR meter. My garage is littered with carcasses of car stereos and other toys that were rewired for little experiments, only to be subjected to momentary loss of sanity (polarity) and quick destruction. If you do something like this modification, please take the time to do it right. The modification has to account for (1) reversed polarity; (2) supplying a trickle charge to the NiCds instead of a fast one; and (3) retaining the original external power connection to keep the unit's original appearance. See Fig. 1 for the original power connections circuit and how it was modified with internal NiCds to accommodate the new charging options.

I have oriented the PC board to show the unit face down and with the back cover removed. I placed the UHF connector up, or at 12 o'clock. Note the connector for external power and its three solder tabs. The top connector is common board ground, the one at lower right is switched to ground

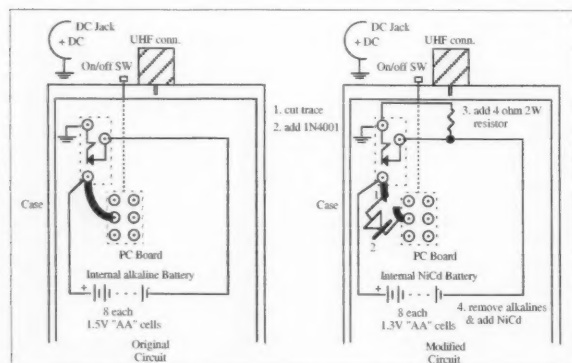


Fig. 1. PC board prior to modifications, and after modifications with DC polarity protection and NiCd 4-ohm current-limiting resistor added.

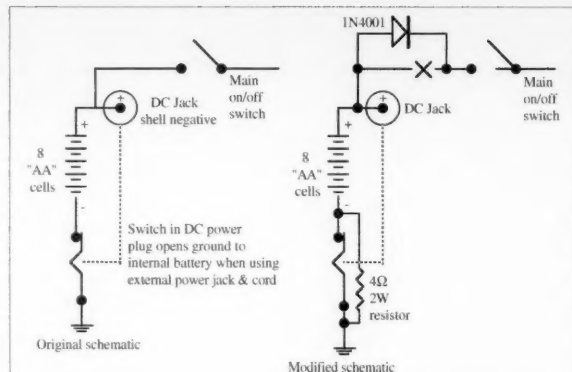


Fig. 2. Basic input electrical schematic circuit of original and modified circuit for NiCds and current-limiting and diode-protection circuit.

(internal to the power connector socket), and the bottom left one is the center connector or +DC voltage. The +DC connection also has a wide trace going to the on/off switch center connector. This trace will be cut and replaced with a rectifier diode for polarity protection.

This diode will not protect the NiCds from reverse charging, but will protect the electronic circuitry of the MFJ SWR meter. To protect the NiCds from reverse charging, add another rectifier diode in series with the 4-ohm resistor connecting diode cathode to ground. Current-limiting is done by the 4-ohm 2-watt resistor that ties the ground and switched ground together as shown in Fig. 2.

Consult Fig. 2 for a brief schematic of the standard circuit before and after modification. You can use this as a guide to "ohmmeter out" the exact points of modification from the power connector to sort of test it prior to modification—just to be sure you and I are talking about the same connections and don't have any misunderstanding.

I have to tell you that operation with NiCds (8 each) will produce about 10 volts. The protection diode will drop that voltage to 9.3 volts for feeding the meter circuits. This is sufficient to operate the meter, but if you are a purist there is a more sophisticated meter polarity circuit that you can install. Normally this circuit is reserved for situations that can't withstand a protection diode and its associated voltage drop.

The no-voltage-drop circuit is accomplished by adding to the original circuit a diode and DC

relay. The diode is connected in series with the DC-relay main coil. This circuit (diode and relay coil) is connected between the main DC power input and ground, with the main DC power to the circuits it is going to protect passing through normally-open relay contacts.

When correct polarity is applied, the relay operates and its contacts close, applying the correct-polarity DC through to the circuit being protected. What happens if reversed-polarity DC is connected to this same protection circuit? The diode in series with the relay coil will not allow reversed current to flow to operate the relay coil. It will prevent the reversed battery from operating the relay coil and save the equipment from possible destruction. See Fig. 3 for details.

Do not test this circuit and mechanically operate this relay, as you will destroy the circuit you are trying to protect. Let the DC voltage operate the relay when the polarity is proper. Remember, the protection circuit can be overcome by manual intervention if someone pushes the relay and closes its contacts. Just don't try to force its operation.

These modifications are quite simple—but don't rush into the project thinking it's a cinch. Take care even when doing an easy project, and don't be overconfident. That's when simple projects can become easy miscalculations. Think it out and verify everything with an ohmmeter to be sure of just what you are doing. And be aware that any modification might void your warranty on a new unit.

I constructed my 4-ohm 2-watt resistors out of two 2-ohm units; wrapped them in heat shrink to insulate them; and then formed the leads and soldered them to the PC board.

The DC power trace feeding the on/off switch was cut in mid-trace position with an X-Acto™ knife. The protect diode is installed with the cathode end towards the on/off switch. Any suitable diode or resistor combination will do the job here, and values or exact parts are not necessary.

The MFJ meter will function as originally intended with the exception that it now has internal NiCd batteries that can be charged from the external connector. The meter can be operated from either the internal NiCd batteries or the external (charging) DC power cable. (Note: The batteries will always be under charge through the 4-ohm limiting resistor in the NiCd battery ground circuit when using the external power option.)

After the modification is complete, the meter can be used with either power feed option, internal or external, and retain its original feel and appearance. I have used my meter with this modification for about 6 months and find it to be very good. I have left the power switch on, or it got bumped on, and I did not notice it. The benefit now is that whenever I pull it out for use I don't have to worry whether the internal batteries are ready to go. If they aren't, I stick it on a bench charger for a fast charge cycle and it's ready for use in less than half an hour.

Of course, NiCds being what they are, I don't get a lot of capacity time in a half hour charge (although it usually is sufficient). With a little planning the night before, you can charge it up overnight, saving the cost of a new set of alkaline batteries.

### The MFJ-219 450-MHz SWR analyzer

While the MFJ-259 will work the full frequency spectrum from 2 MHz to just over 170 MHz, what can be done for 1-1/4 meters (450 MHz)? Well, they also make an SWR meter (the MFJ-219) with internal generator for the 450-MHz frequencies. I picked one up, tried it on the 432-MHz

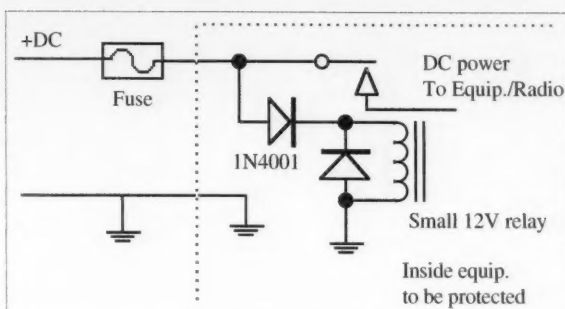
antenna project, and am happy to report it works just fine. And while this meter is touted to operate from 420 to 450 MHz, I discovered it has a few other extra benefits.

I found the 219's frequency readout scale to be inaccurate outside the amateur bands markings. Using the calibration markers to their extreme, I found that the unit I have will function from 410 MHz to slightly over 465 MHz. This allows measurements in the commercial portion of the 450 MHz frequencies to nearly 470 MHz. I suspect it could be coaxed up there, if that is your interest, by a slight tweak of the oscillator coil. To know what frequency the meter is set at, use the external frequency meter connector and get a direct readout.

This unit is quite a bit smaller than the VHF (259) one and the circuitry is quite dense. There is just about enough room for the two alkaline 9-volt transistor batteries. If I were to make a similar NiCd modification to this MFJ-219 unit, the 9-volt variety would still have to be retained even though there is not much time-to-current capacity in this type of battery. The bottom line is that there is no room for a larger battery. The electronics package takes up most of the case interior and thus this unit will stay unconverted for the time being. I am shopping for 9-volt NiCd bargains and will modify the unit when they are picked up.

The alkaline variety of 9-volt batteries will give good performance, but due to their cost and limited mAh capabilities, you think twice about leaving this unit on for extended periods of time. To conserve the 9-volt batteries, I recommend you make your test and then turn the power off until the next one. Life is not all that bad, as I left the battery switch on for a half hour while transporting the unit from a field trip and still had battery life to operate it. It's just that I am now on the verge of purchasing a replacement set of new 9-volt alkaline batteries, and that tugs on the wallet.

My recommendation here, due to the limited size, is to keep the alkaline batteries and get an external power connector and 12-volt rechargeable battery to use for extended test sessions. For



**Fig. 3.** Alternate no-voltage-drop reversed-voltage-protection circuit using a DC relay and a small diode rectifier. Relay will not operate unless the polarity is positive on the input lead, which then closes the relay contacts. Select a relay with contacts that will carry the amperage of the unit you are trying to protect.

you purists out there, the dial calibration in the amateur segment is quite good for reference use. However, for band-edge operation you might be well advised to attach an external frequency meter to the sample port for accurate frequency readings. Operation with the external frequency meter removes all doubt as to your exact frequency.

There are several adjuncts that can prove to be very useful with the MFJ-259 SWR analyzer. This little self-contained unit intended for aligning antennas can be put to use in many other applications, making it very versatile.

Both the 259 and the 219 can be used as a general-purpose bench signal generators to adjust circuits within their respective frequency ranges. Such a unit is not suitable for SSB narrowband receiver tests, but it can be a great help for workbench circuit testing when you connect it to a simple resistor attenuator diode detector arrangement. Testing resonant circuits like cavities and other bandpass circuits is quite easy. The SWR analyzer is not a tool that is used every day, but when it is needed for antenna analysis or other tasks, both of these units work well. Here is a brief rundown on the two SWR analyzers.

The MFJ-259 HF/VHF unit is capable of operation from 1.8 MHz to 174 MHz in a six-band step arrangement. The output of the signal generator is nearly 200 mW. The high power output can be quite useful in adjusting circuits that need to be attenuated, such as cavities that are out of resonance. The power output can be adjusted with an external resistor

step attenuator as you get near resonance and lower loss. Used together with the internal frequency readout indicator, this makes for a very powerful bench signal generator.

As with all basic units, there is always something more that can be added to a device to make it more useful. The analyzer as it comes from the factory is quite a powerful tool that is usable with ease to adjust antennas in its frequency range. One more stock feature might make this unit really shine. It would be to add a protective case to allow outdoor use without subjecting the analyzer to rough handling and perhaps accidental jarring. The MFJ-29 case, available separately, is not expensive (\$20) and affords the meter a good deal of protection. I found a small Tektronics pocket o-scope case at our local swapmeet (for a buck) to protect the meter, and it works well.

The MFJ-219 UHF SWR analyzer doesn't need a carrying case, as it is more robust than the more delicate 259 meter with its LCD display to protect. I provided a case for my unit, as I don't want it to get tossed around. After all, it's still a precision instrument that needs protection if you expect to make reasonable test results. I am on the lookout for a single carrying case for both units and their accessories, and have been looking at the feasibility of some small computer laptop case for this purpose. There are a lot of surplus laptop computer cases on the market for very reasonable prices, so we will see what turns up. 73, Chuck WB6IGP. 73

# Ask KABOOM

## Your Tech Answer Man

Michael J. Geier KB1UM  
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Peterborough NH 03458

### Color me video!

For the past few months, we've been exploring the development of television, and the makeup of video signals. This time, let's take a close look at the color, or "chroma," signal.

As I mentioned last time, it was decided that the color information could be separate from the brightness, or "luminance," portion of the picture, and could be hidden on a subcarrier riding on the baseband video itself. (By "baseband," I mean the actual video signal, rather than the radio signal coming from a transmitter.) We took a look at the basic scheme: a high-frequency signal, non-harmonic with the line scanning rate, simply added to the video signal. But how do you get that one signal to represent the two essential color elements of hue and saturation?

### Matrix!

If you're familiar with FM stereo broadcasting (which came much later, but that's irrelevant here), you know how two signals can be added and subtracted from each other algebraically. Hmmm, let's take a quick detour and go over it; the concept is crucial to understanding color video signals.

To add two signals, you feed them through resistors which meet at a common point. To subtract them, you invert one first (turn it upside down), and then do the same thing. The resulting voltage at the common point will represent the combination of the two signals, either an addition or a subtraction, depending on whether one of the signals was inverted. And, of course, that voltage will move up and down as the signals change.

In stereo audio, there are two items to represent: left and right. So, you can create two matrixed signals: L+R and L-R. FM stereo

sends the L+R signal (which is simply a mono mix of the two channels) on the main carrier, and sends the L-R signal on a subcarrier. That way, a mono receiver will hear a normal mono signal, while ignoring the L-R subcarrier. The stereo receiver, though, will detect the carrier, recover the L-R signal, and then mix it twice with the L+R signal. Twice? Yes—one mix will be an addition, which will produce  $(L+R) + (L-R)$ , which equals  $2L + 0R$ , or simply  $2L$ . The other mix will be a subtraction (by inverting one of the signals first), which will produce  $(L+R) - (L-R)$ , or  $0L + 2R$ , or simply  $2R$ . Thus, the L and R signals are recovered. Pretty slick, huh?

Color TV used the same idea, but it was a little bit more complicated. Since there were three colors to represent (red, green and blue), the matrix consisted of three elements. Sending three elements on one subcarrier, though, would have been rather tricky, as it would have required sequential timing circuits, tough to implement with the vacuum tube technology of the day. Sending two, though, wasn't overly hard, as any AC wave (such as the subcarrier) has two polarities, positive and negative, which can be used to represent two elements of information, and then be separated at the receiver. Was there a way to reduce the matrix to two elements and still recover all three colors?

### Ta da!

In this case, yes. Luckily, the luminance signal was there, too, and could be used as part of the equation. Let's see how they did it:

The luminance signal, called "Y" (Y call it that?—I don't know), was used as a reference. It, of course, was just an addition of R, G and B. By subtracting Y from each individual color signal, R-Y, G-Y and B-Y were produced. Then, the G-Y signal was simply discarded! What?? How could they ever recover the green information if they threw G-Y away?

In order to grasp the recovery of the green signal, it's important to keep the relationship of Y to the chroma signals in mind. Remember, the Y signal is a combination of all three original, pre-matrixed red, green and blue signals. So, if you recover the R-Y and B-Y signals (we'll get to how they did that, in a moment), and then add Y to each of them, you've got the R and B signals back. Now, add those together and subtract the result from Y, and what's left is the amount of G that

of saying that the receiver regenerates the equivalent of an unmodulated subcarrier, and then compares it to the real one. The unmodulated one tells the receiver when the positive and negative peaks should occur, letting it examine each polarity separately. In other words, time, rather than amplitude, is used to find the occurrence of the two polarities.

How to do that? Luckily, quartz crystals are pretty stable. If you synchronize a crystal oscillator to a reference signal, and then

---

**"Sending three elements on one subcarrier would have been tricky with the vacuum tube technology of the day."**

---

was in the Y signal. In other words, green, which was hiding in there all along! This is a classic, if convoluted, case of solving for one missing variable when the other two are known. It's detective work, more or less.

### Ride 'em, subcarrier

Since Y would be available at the other end of the process, this crazy thing could actually work—but the problem of how to encode R-Y and B-Y onto one subcarrier remained.

Remember when I mentioned that you could use the two polarities of the subcarrier independently? Well, why not? What if you used the amplitude of the negative peaks, say, for the B-Y signal and the amplitude of the positive peaks for the R-Y? Would that work? It sure would! (Actually, I don't remember which peak was used for which, and my video reference books are all packed away. But it doesn't matter; the principle is the same.)

OK, it was in there, but how the heck could you recover that information? With a normal, symmetrical AC waveform, the center, or zero-crossing, line is easy to find. But this thing would be riding along on top of the Y signal, so its center line would be wandering all over the place! Simple amplitude detection of the positive and negative peaks wouldn't work.

### Synchronize your crystals!

The answer lay in synchronous detection. That's just a fancy way

remove the reference, the oscillator will stay in "blind sync" with the reference for a short period of time before drifting off into never-never land. You'd never get away with that sort of thing using an LC oscillator, but it works with a crystal. Of course, a "short period" is a subjective quantity. Luckily for color TV, that time period only needed to be 62.5 microseconds, or the length of one horizontal line.

So, a reference signal was placed at the very end of each horizontal sync pulse. Called the "colorburst," it consisted of about seven cycles of the unmodulated color subcarrier frequency. It was easy enough to create a "burst gate" circuit which let only that signal pass, since the horizontal sync could be used to trigger the gate. The reference burst could then be used to sync the crystal oscillator, with new color sync occurring at the start of each horizontal line, right after the horizontal sync pulse, and before any picture information would be displayed.

Using the phase-locked crystal oscillator as a time reference, the synchronous detector could extract the values of R-Y and B-Y encoded on the opposite peaks of the subcarrier. All it had to do was examine the voltage value of the subcarrier when the reference was in, say, the positive state, and assign that to R-Y, and then do the same when the reference was in the negative state, and assign that to B-Y. Thus, the two signals were split off and recovered, and then sent to



the matrices that recovered green and finally outputted R, G and B! All that was left was amplifying them, sending them to the picture tube's electron guns, and enjoying the resulting color picture.

Whew!

I realize that was pretty complicated—it might pay to read it over a few times and let it sink in. Basically, it was all a clever matrixing scheme, designed to fit a color picture into nearly the same bandwidth as a monochrome one. And it worked!

## Almost perfect

There was one little anomaly, though, and we live with it today. Although the colorburst signal did provide a reference for the synchronous detector, it didn't say anything about how accurately the transmitted color values represented the picture. And, unfortunately, various TV stations and networks weren't too uniform about that. Plus, phase shifts in the TV's circuits could throw the process off even further. So, even though the TV set might seem to be working perfectly, sometimes the color was off. Enter the hue control.

By varying the phase of the synchronous detector's reference (from the crystal oscillator), values intended for one color could be made to appear in another color, because the detector would be looking at the wrong part of the waveform, due to the time difference. As the phase was continuously varied, the hue of the picture would shift. The hue control, which shifted the reference oscillator's phase, could be manually adjusted to get everything in line for the best perceived picture. By the way, some other TV systems, in use in other parts of the world, have reference signals that eliminate the need for a hue control. Oh well, that's the price we paid for being first in color TV.

The upshot of all this color encoding is that color signals are very time-sensitive. So what? Well, it all works fine for live broadcasting, but it played havoc with the development of color video recording. Next time, we'll begin exploring the recording of TV signals. It's a fascinating topic in and of itself. Until then, 73 de KB1UM.

73

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# Barter 'n' Buy

Turn your old ham and computer gear into cash now. Sure, you can wait for a hamfest to try and dump it, but you know you'll get a far more realistic price if you have it out where 100,000 active ham potential buyers can see it than the few hundred local hams who come by a flea market table. Check your attic, garage, cellar and closet shelves and get cash for your ham and computer gear before it's too old to sell. You know you're not going to use it again, so why leave it for your widow to throw out? That stuff isn't getting any younger!

The 73 Flea Market, **Barter 'n' Buy**, costs you peanuts (almost)—comes to 35 cents a word for individual (noncommercial) ads and \$1.00 a word for commercial ads. Don't tell a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so. Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad. This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham newcomer or retired old-timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

Send your ads and payment to: 73 Magazine, Barter 'n' Buy, 70 Rt. 202N, Peterborough NH 03458 and get set for the phone calls. The deadline for the August 1997 classified ad section is June 5th, 1997.

**TOWER 100'** guyed 2' triangular, 10' sections, MIL/AB-105C, ExHD Galvanizing. Dismantled, ready to go. Includes 1/4" guy wire, screw anchors. Excellent condition. Details Phone/FAX, **Jim W9GLR**, Polk City FL (941) 984-1317. BNB1600

**LARGE ASSORTMENT** of used test equipment. Most instruments are priced at 10% of original cost or less. Request list. **Jim Stevenson**, 3401 Sunny Slope Road, Bridgewater NJ 08807; (908) 722-6157, FAX: (908) 722-6391. BNB2084

**ASTRON** power supply, brand-new w/ warranty, RS20M \$99, RS35M \$145, RS50M \$209. Call for other models. (818) 286-0118. BNB411

**The PHDARA Hamfest 3 May** 8-4PM at the KC Market Center. **Bob WA0CLR** (816) 436-0069, wa0clr@juno.com or Box 28954, Kansas City MO 64188-8954. BNB205

**WANTED:** G-VG+ cond older mobiles/hits: IC22A/S/U, 33U, 1C2/3/4A/AT, 13-509/76ers, most any non-mem synth rigs. Also xtals + assys for above. **Mark Whiteman N7TRZ**, NE 114 Ave., Portland OR 97220-2245, 503-257-3820. BNB203

**Audio Equipment wanted.** 1930s-1960s. Tube-type amplifiers, large or small speakers, mixers, microphones, tubes, parts, etc. Especially Western Electric, Jensen, Marantz, Macintosh, JBL, etc. **1-800-251-5454**. BNB202

## NEVER SAY DIE

Continued from page 55

me with a lifetime of adventure and, apparently, no excitement or adventure for you. Oh, I've tried to get you interested in our ham satellites. I failed. I've tried to get you on slow scan. Failed again. I've tried to get you up to 10 GHz, where I worked seven states. No sale. I've talked up DXpeditioning. Even mini-DXpeditioning to the Caribbean or some nearby spot like St. Pierre. Another blank.

And when I write about the fun I've had doing the above I get carping crapola about my ego. I haven't suggested doing anything I haven't done. And I'm just a guy who's been dumb enough to make his hobby his life's work. Hey,

what could be more fun? But when I suggest that you consider getting out of the rat race of working for someone else and experiencing the freedom of having your own business, you just sink lower into your commuting rut and yawn. Get some smelling salts or a bottle of ammonia and come out of that hypnotic trance you've been in for the last few years.

Grumble.

## Hey! Wake Up!

What is it going to take to blast you out of that rut you're in?

Rut? Me? Yes, you! If you are working for someone else—if you are commuting to work every day—if you are sick—if you aren't an exciting and interesting

**MAHLON LOOMIS, INVENTOR OF RADIO;** by Thomas Appleby. (© 1967). Second printing available from **JOHAN K.V. SVANHOLM N3RF**, SVANHOLM RESEARCH LABORATORIES, P.O. Box 81, Washington DC 20044. Please send \$25.00 donation with \$5.00 for S&H. BNB420

**BREAK THE CODE BARRIER:** A self-hypnosis tape that allows you to learn or increase code speed easily and quickly. To order send \$14.95 + \$3.00 S&H to **Dr. Hal Goodman**, P.O. Box 184, Eastport, ME 04631. For more info, send SASE or [http://www.nemaine.com/w3uw/morse.htm] BNB2031

**HEATH COMPANY** is selling photocopies of most Heathkit manuals. Only authorized source for copyright manuals. **Phone:** (616) 925-5899, 8-4 ET. BNB964

**CLASSIC RADIOS** RadioFinder Web list revised weekly: [www.radiofinder.com] TEL/FAX (313) 454-1890 [finder@radiofinder.com]. BNB700

**DSS BIBLE Volume 2.** All new information - No duplication from Volume 1. 200+ pages, 280+ files, \$79.95 + \$5.50 P+H. **DSS BIBLE Volume 1.** - \$49.95 PPD. **DSS SECRETS** - All Patents \$69.95. All \$179.95. VISA/MC **TELECODE1**-520-726-2833. [http://www.hackerscatalog.com] BNB1024

**PRINTED CIRCUIT BOARDS** for amateur radio and hobby projects. [http://www.cl.ais.net/farcir] or **SASE FAR CIRCUITS** 18N640 Field Ct., Dundee IL 60118, (847) 836-9148. BNB5013

**RF TRANSISTOR TUBES** 2SC2879, 2SC1971, 2SC1972, MRF247, MRF455, MB8719, 2SC1307, 2SC2029, MRF454, 2SC3133, 4CX250B, 12DQ6, 6KG6A, etc. **WESTGATE**, 1-800-213-4563. BNB6000

person. I've been-there-done-that.

When I was a kid I commuted to high school, an hour trip on the jam-packed New York subway every morning and afternoon. Then there was the time a few years later when I was an engineer at Airborne Instrument Laboratories in Mineola and commuted an hour each way from Brooklyn. I tried it via the subway and the Long Island Railroad, and I tried it driving the Belt Parkway and the Grand Central Parkway. Both ways sucked. But then I was in as deep hypnosis as you and didn't know any better. Yet.

I've been through the hiring and firing routines, complete with résumés and interviews.

Continued on page 81

# SPECIAL EVENTS

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the September issue, we should receive it by June 1. Provide a clear, concise summary of the essential details about your Special Event.

## MAY 2 & 3

**KINGSBURG, CA** The Fresno ARC, Inc., will host its annual Hamfest at Riverland RV Park, 3 miles south of the town of Kingsburg, on Freeway 99. The hamfest will be held 7 AM-4 PM, Sat., May 3rd. Hams begin to arrive at the park on Fri. May 2nd, with plenty of RV parking available. Displays of new and vintage radio equip. and swap tables loaded with used radio equipment for sale or trade will be featured. VE exams for all classes. Information will be exchanged on new radio operations, new radio equipment, and operator techniques to improve work in disaster and emergency services. Contact *Fresno ARC, Inc., P.O. Box 783, Fresno CA 93712*.

## MAY 3

**CADILLAC, MI** The Wexauke ARC will hold their annual Hamfest, 8 AM-2 PM, at the Cadillac Middle School. VE exams for all classes at 1 PM. Adm. \$5; 8' table \$6. Setup at 6 AM for table holders only. Talk-in on 146.98 rptr. Contact *Dan KE8KU, Wexauke ARC, P.O. Box 163, Cadillac MI 49601. Tel. (616) 775-0998*.

**KANSAS CITY, MO** The PHDARA will hold its annual Hamfest 8 AM-4 PM at the Kansas City Market Center, I-435 and Front St., south of Worlds of Fun. Vendor tables \$40/\$20, flea market tables \$10, radio club tables, call for price. Adm. \$6 advanced, \$7 at the door. Contact *Bob Roske WA0CLR, Box 28954, Kansas City MO 64188-8954. Tel. (816) 436-0069; E-mail [wa0clr@juno.com]*.

## MAY 3 & 4

**ABILENE, TX** Abilene will again be the site for the ARRL West Texas Section Convention and the Key City ARC Hamfest. Prearranged setup for dealers and manufacturers

on Fri., May 2nd, 4 PM-9 PM. Setup for all others, including dealers arriving late, will begin at 6 AM, Sat., May 3rd. For info and reservations, call *Peg Richard KA4UPA, (915) 672-8889* (leave a message, your call will be returned); or E-mail *[jimr@swconnect.net]*. Find more info on the Web site at *[http://www.acu.edu/~cummingsg/kcarc.html]*.

## MAY 4

**BLOOMINGTON, IN** The Amateur Radio Go Getters will host their 3rd Annual AA9HI Hamfest at Monroe County Fairgrounds, 8 AM-3 PM. Setup Sun., 5 AM-8 AM. VE exams reg. at 11 AM, testing starts at 11:30 AM. Inside vendors: \$5 per table, \$5 per elec. hookup, \$5 per ticket. Outside vendors: \$5 per flea market space, \$5 per ticket. Talk-in on K9TC rptr. 146.895(-) MHz (Tim Crafton K9TC). Contact *John Anderson AA9HI, (812) 332-3734 after 5 PM; or Randy Kinser KF9NA, (812) 332-3588 after 7:30 PM*.

**HAGERSTOWN, MD** The Antietam Radio Assn. will present the 5th Great Hagerstown Hamfest and Computer Show at the Hagerstown Jr. College, Athletic. Rec. and Community Center. Talk-in on 146.940(-) and 146.520 simplex, the night before and the day of the event. Adm. \$5, children under 12 admitted free. Write to *Antietam Radio Assn., Inc., P.O. Box 52, Hagerstown MD 21741*.

**WRIGHTSTOWN, PA** The 23rd Annual Hamfest of the Warminster ARC will be held at the Middletown Grange fairgrounds, Penns Park Rd., starting at 7 AM. Setup at 6 AM. 8' tables \$12 ea., pre-reg. recommended. Unlimited outdoor tailgating spaces \$9 ea. Computer hardware and software vendors are invited to participate. Adm. \$6, unlicensed spouses and children under 12 free. VE exams at 11 AM; reg. at 10:30 AM. Applicants bring

original and copy of present license and/or certificates of successful completion, two forms of ID and the \$6.25 examination fee (Novice class free). Talk-in on 147.09/.69 rptr. and 146.52 simplex. Contact *John D'Onofrio, 1255 Manor Dr., Warminster PA 18974-2102. Tel. (215) 675-9165, 9 AM-9 PM. E-mail [warc@crompton.com]*.

**YONKERS, NY** The Metro 70cm Network will host a Giant Electronic Flea Market at Lincoln H.S., Kneeland Ave., 9 AM-3 PM, rain or shine. Indoor flea market only. 1st table, \$19; each additional table \$15, or bring your own tables at \$14 for a 6' space. At the door, \$25 each table, \$20 ea. 6' space. Full payment due with reg. Adm. \$6, kids under 12 free. Setup at 7 AM. For reg., contact *Otto Supliski WB2SLQ, 53 Hayward St., Yonkers NY 10704. Tel. (914) 969-1053*. Talk-in on 449.425 MHz PL 156.7, 223.760 MHz PL 67.0, 146.910 Hz, and 443.350 MHz PL 156.7.

## MAY 8 & 22

**FORT WORTH, TX** The Lockheed ARC and the Kilocycle Club will sponsor VE exams for all classes at the Lockheed Rec. Area Facility, 2400 Bryant Irvin Rd., at 7 PM. For details, call *Ted Richard AB5QU, (817) 293-6745*. GROL testing done by appointment only.

## MAY 10

**GREENVILLE, SC** A hamfest will be sponsored by the Blue Ridge ARS, 8 AM-5 PM, at the Anderson County Fairgrounds, E of Anderson on Hwy. 29 Business. Flea market, Buck Rogers, K4ABT SEDAN packet conference, VE exams at noon, overnight camping, free parking. Talk-in on 146.01/.61. Advance adm. \$4; \$5 at the door. Contact *Gene WB4ZBZ, or David KE4QQQ, (864) 476-2609, E-mail: [ke4qqq@innova.net]*.

**HURON, SD** The Huron ARC will sponsor their 4th Annual Amateur Electronics Swapfest 8 AM-3 PM at the Nat'l. Guard Armory, SD State Fairgrounds. Flea market setup 7 AM, VE exams 9 AM. Talk-in on 147.09(+). Contact *Lloyd Timperley WB0ULX, P.O. Box 205, Huron SD 57350. Tel. (605) 352-7896 eves*.

**MEDINA, OH** The Medina County Hamfest will be held at the Medina County Community Center, 735 Rt. 42. VE exams at 9 AM. Tables \$6, outdoor space \$4, entrance \$4

donation, \$3 advance. Talk-in and directions on 147.03 rptr. For more details, contact *Medina Hamfest, P.O. Box 452, Medina OH 44258*.

## MAY 15-18

**DAYTON, OH** The "Four Days In May"™ QRP Symposium on Thursday, May 15th, held in conjunction with the Dayton hamvention®, will kick off QRP activities at Dayton. Full day of activities on Thursday at the Days Inn Dayton South (513-847-8422); includes multimedia QRP presentations, catered lunch, door prizes, tech talks, tutorials by clubs. Thursday registration \$30 before May 1, \$35 after (if still available). Make checks payable to "Bob Follett" and send to: *Bob Follett AB7ST, 2861 Estates Dr., Park City UT 84060, E-mail: [bfollett@ditell.com]*. On Fri., May 16th, the QRP-ARCI Awards Banquet will be hosted by FDI Banquet Chairperson Pete Meier WK8S. Please send \$15 banquet ticket fee (US check, MO, internat'l MO) made out to "Pete Meier" by May 1st. Mail to *Pete Meier WK8S, 4181 Rural, Waterford MI 48329; or E-mail [pmeier@tir.com]*. Also on the 16th, Preston Douglas WJ2V will host the FDI QRP Vendor Evening Social. To register, contact *Preston Douglas WJ2V, QRP Vendor Evening Chairperson, 216 Harbor View N., Lawrence NY 11559, or via E-mail: [pdouglas12@aol.com]*.

## MAY 16

**DAYTON, OH** The southwest Ohio Chapter of the Quarter Century Wireless Assn. will hold its 1997 Annual Banquet in conjunction with the Dayton Hamvention. Alex's Continental Restaurant, 125 Monarch Lane, is the location for a C.O.D. bar at 7 PM, and a banquet at 7:30 PM. Reservation deadline is May 14th. QCWA membership is not a requirement for attendance. Tickets are \$15 ea.; make check payable to *Robert L. Dingle, Treas., Chapter 9, and mail to 1117 Big Hill Rd., Kettering OH 45429-1201*. Charles Stinger WB8GFA, former mgr. of Voice of America Radio Station at Bethany OH, will give an inside look at this powerful transmitting station.

## MAY 16, 17, 18

**DAYTON, OH** The Dayton Hamvention, sponsored by the Dayton ARA, Inc., will be held at the Hara Arena. Fri., May 16th: Flea Market open and bus service avail., 8 AM-

6 PM; Exhibits, Noon-6 PM; Forums 1 PM-5 PM. Sat., May 16th: Flea Market and bus service 7 AM-5 PM; Exhibits 8 AM-5 PM; Forums, VE Exams, Activities, 9 AM-5 PM; Hamvention Banquet at the downtown Dayton Convention Center, 6 PM. Sun., May 17th: Flea Market 7 AM-4 PM; Bus service available 7 AM-5 PM; Exhibits open 8 AM-2 PM; Forums and activities 9:30 AM-1:30 PM: Prize drawings 2 PM. Programs available Fri. at 7 AM in the Hara Arena lobby and in the tent in front of the East Hall entrance. Flea Market spaces are sold in advance only; a maximum of 3 spaces per person (non-transferable). Limited to amateur radio, electronic, and related items only. Electricity available in a portion of the last Flea Market row for \$60 a space extra. Tables and chairs not available. Contact the *Flea Market Chairman* by FAX at (937) 253-1289, by E-mail at [fleaamt@hamvention.org], or by voice mail at (937) 276-6932; allow 30 seconds for the phone routing system to transfer the call. Registration tickets in advance \$13, at the door \$15. Banquet tickets in advance, \$25; after May 17th, if available, \$30. Flea Market spaces \$50/1 space, \$110/2 adjacent, \$220/3 adjacent; elec. \$60 extra each space. Covered tent w/elec. \$325 ea.

#### MAY 17

**COLORADO SPRINGS, CO** Pikes Peak Radio Amateur Assn. will host a hamfest at Doherty H.S., 4515 Barnes Rd. Adm. \$4; 1st table \$12, each additional table \$10. AC limited to outside wall tables, bring extension cord. Free parking. Setup May 16th, 6 PM-9 PM; vendors 6 AM on the 17th. Talk-in on 146.97/100 Hz, and 146.52 simplex. Contact *Dennis Major KBØSXC* at (719) 535-1160; or E-mail [DENNIS.MAJOR@MCI.COM].

#### MAY 23 & 24

**PASCAGOULA, MS** The Jackson County ARC will hold its 3rd Annual Hamfest in the Pascagoula MS Civic Center, Jackson County Fairgrounds. Hours are 1700Z-2100Z May 23rd, and 0800Z-1500Z May 24th. Adm. \$2.50 for 12 yrs and older, under 12 free. Tables \$8 per 8'. Free parking. RV parking in designated areas only, electric only, no dumping station. Nearby hotels and motels at reasonable rates. VE exams available at

0900Z Sat., May 24th. Prearranged meeting rooms for any amateur organizations. Talk-in on 145.110(-). Contact *Charles F. Kimmerly (Kim) N5XGI*, 19000 Busby Rd., Vancleave MS 39565. Tel. (601) 826-5811.

#### MAY 25

**HILLIARD, OH** Flyers, sailors, and amateur radio operators are invited to come and search for that perfect bargain at the Franklin County Hamfest. The event begins at 8 AM at Franklin County Fairgrounds. Adm. \$5 per person. Inside tables \$5 ea. Outdoor space \$5 per 4 wheel vehicle. Setup at 6 AM. Call for advance tickets. Overnight camping with electric hookup is available on the grounds. Contact *Chris Lind*, P.O. Box 14281, Columbus OH. Tel. (614) 267-7779; FAX (614) 263-7934.

#### JUN 1

**MANASSAS, VA** The Ole Virginia Hams ARC will sponsor the Manassas Hamfest and Computer Show at the Prince William County Fairgrounds, on Rte 234. Gates open to public 8 AM, tailgaters 7 AM. General admission \$5, tailgating \$5 additional per space. All activities are wheelchair accessible. Talk-in on rprr. 146.37/146.97 and 223.06/224.66. Unlimited tailgating space. For more information: Commercial vendors contact *Jack N4YIC* at (703) 335-9139; General information contact *Mary Lu KB4EFP* at (703) 369-2877.

**PRINCETON, IL** The Starved Rock Radio Club Hamfest will be held at the Bureau County Fairgrounds, starting at 6 AM. Advance tickets are \$5 with 4 stubs before May 20th, and \$6 with a single stub at the gate. Camping and outdoor flea market area is free. 8' tables indoors are \$10 ea. Talk-in on 146.355/1955 PL 103.5. Contact *Bruce Burton KU9A*, or *Debbie Burton N9DRU*, 1153 Union St., Marseilles IL 61341-1710. Tel. (815) 795-2201; E-mail [brburton@mtco.com].

**QUEENS, NY** The Hall of Science ARC Hamfest will be held at the New York Hall of Science parking lot, Flushing Meadow Park., 47-01 111th St. Vendor setup at 7:30 AM; buyers admitted at 9 AM. Free parking. Adm., buyers \$5, sellers \$10 per space. Talk-in on 444.200 WB2ZZO rprr, and 146.52 simplex. For more info, call, eves. only, *Amie*

*Schiffman WB2YXB*, (718) 343-0172.

#### JUN 7

**TEANECK, NJ** The Bergen AREA will hold its annual Spring Hamfest at Fairleigh Dickinson Univ. Buyer adm. \$3, with XYLs and harmonics free. Seller adm. \$10. VE exams. Talk-in on 146.790/600. Contact *Jim Joyce K2ZO* at (201) 664-6725 before 10 PM.

**GRAND RAPIDS, MI** The annually sponsored IRA Hamfest will be held at Hudsonville Fairgrounds near Grand Rapids. Doors open at 8 AM for general adm. Dealers can set up on the 6th after 7 PM, or after 6:30 AM on the 7th. Overnight camping. Bring your equip., etc., to sell and trade. VE exams at 8:30 AM. Talk-in on 147.16 link rprr. system. Reserve early for the best spots. Indoor table space and trunk sales spaces available. Contact the IRA voice mail/info line at (616) 534-6803; or *Tom KA8YSM* or *Kathy KB8KZH* at (616) 698-6627.

#### SPECIAL EVENT STATIONS

##### MAY 2, 3 & 4

**FALL RIVER, MA** W1ACT, the Fall River ARC's annual DXpedition to Martha's Vineyard (IOTA-NA046), and Massachusetts QSO Party, will operate on the following freq.: CW—1810, 3550, 7050, 14050, 21050, and 28050; SSB—1850, 3890, 7290, 14260, 21390, 28390, 146.550, 446.000 (FM), 434.0, and 439.25 MHz (ATV). Send an SASE for QSL via *N1JOY*, 19 Davis Rd., Westport MA 02790. E-mail [roland@ici.net].

##### MAY 3

**NOVI, MI** The 1st Annual Novi Special Race Car (Indy 500) Celebration will be sponsored by the Novi ARC, 1400Z-2100Z. The club will use the callsign KC8FSW. Freq.: CW—7.030, 7.125, 21.050, 21.150; PHONE—14.225, 14.250, 14.300, 21.325. Please request "Car Photo QSL." QSL to N.A.R.C., P.O. Box 268, Novi MI 48376-0268. For more info, call *Greg Tullar KB8UBL* at (810) 474-3633.

##### MAY 3-4

**DANBURY, CT** The fabulous 1997 Connecticut QSO Party will be sponsored by the Candlewood ARA, 2000Z May 3rd-2000Z May 4th, with a rest period 0400Z-1200Z.

Phone, RTTY and CW. For operating rules, contact *CARA*, P.O. Box 3441, Danbury CT 06813-3441 USA. Please remember to send an SASE.

**PHILADELPHIA, PA** The Olympia ARC will operate WA3BAT from 1300Z May 3rd-2000Z May 4th, to commemorate the 99th anniversary of Admiral Dewey's triumph over the Spanish fleet at the Battle of Manila Bay. SSB/Phone: 3.898.5, 7.248.5, 14.248.5, 21.368.5, 28.368.5, 145.270 FM. CW: 3.710, 7.030/110, 14.030, 21.040/110, 28.025. For a certificate, send QSL and a 9" x 12" SASE to *Olympia ARC, Independence Seaport of Philadelphia*, 211 South Columbus Blvd., Philadelphia PA 19106 USA.

##### MAY 10 & 11

**FLOYD, VA** The Foundation for Amateur International Radio Service (FAIRS) will operate FAIRS Club stations N4USA, US5WE, BY1QM, 8R1WD and S21AM, to celebrate the 6th anniversary of FAIRS. Freq.: General portion of 40, 20, and 15 meters. For a certificate, send QSL and a 9" x 12" SASE to *FAIRS*, P.O. Box 341, Floyd VA 24091 USA.

##### MAY 17

**TAMA, IA** The South Tama ARS will operate WDØGAT 1500Z-2300Z to celebrate the annual Lincoln Highway Bridge Festival. Operation will be in the General 40-15 meter phone, Novice 10 meter phone, and 2 meters. For a certificate, send your QSL and a 9" x 12" SASE to *STARS/WDØGAT*, P.O. Box 94, Montour IA 50173.

##### MAY 31

**NEW PORT RICHEY, FL** Pasco County RACES "Disaster Fair," will be held 1300Z-1700Z on 14.225/.275 and 28.400(±) QRM. For a certificate, contact *Michelle Baker, EOC*, 8744 Government Dr., New Port Richey FL 34654 USA.

### Radio Bookshop

Phone 800-274-7373 or 603-924-0058, FAX 603-924-8613, or see order form on page 88 for ordering information.

### Cold Fusion Journal

Try a 12-issue subscription for \$50. This is going to be one of the largest industries in the world in a few years, and the ground floor is still open.



# HOMING IN

## Radio Direction Finding

Joe Moell P.E. K0OV  
P.O. Box 2508  
Fullerton CA 92633

Many hams can't imagine turning a VHF beam or quad in a moving car, but it's a common sight here in southern California and lots of other places. When signals are weak, nothing else pulls them in and gives sharp directional bearings. What's more, nothing works better when the signal you're hunting is horizontally polarized.

As you remember from studying for your Element 2A test, the orientation of an antenna's radiating elements determines the polarization of the electrical component of the transmitted or received RF wave. Let's say that the path between a transmitter and receiver is line-of-sight. Transmit and receive antennas are polarized at right angles, one horizontal and one vertical. This cross-polarized condition results in the signal at the receiver input being weaker by as much as 20 dB, which is the difference between full scale and zero on most VHF-FM S-meters.

Now imagine what happens when that perpendicularly polarized signal strikes a building, mountain, or other non-absorbing object larger than a few wavelengths. The signal will be reflected or scattered. The scattered signal will have polarization components that are horizontal, vertical, and all values in between. As a result, scattered signals will be stronger at

your receiver input than a direct cross-polarized signal.

On a T-hunt, if the polarization of your RDF antenna is not the same as that of the transmit antenna, reflected signals will be enhanced relative to the direct signal. If the hidden T is in an area of high signal reflections and if the polarization you choose is perpendicular to it, you may chase signal reflections from start to finish. Unless the T-hunt rules in your area prohibit non-vertical polarizations, make sure your quad or yagi has provisions to adjust polarization to match the target signal.

The *T-Hunt Book* shows an easy way to put a slipjoint on your quad's boom/mast junction so you can turn the boom to vary polarization. The book also has lots of ideas for easy ways to mount the rotating mast of your beam or quad on your vehicle for safety and ease of use. For an all-electronic method of polarization selection, see "Homing In" for February 1997.

Getting RDF bearings with a yagi or quad is simply a matter of turning your beam for maximum signal and driving in that direction as roads allow. Your receiver's S-meter is usually better than your ears for detecting the signal peaks, so be sure to locate it such that it is easily viewed by the driver and any RDF helpers. When the signal is too weak to deflect the meter, turn for the clearest audio with best "quieting" of noise.

As you get closer to the signal you're seeking, your S-meter will go to full-scale no matter where the beam is pointed. RF attenuation in the coax line from antenna to receiver will knock the signal down to within the meter's dynamic range. Resistive attenuators like the one in **Photo A** are easy to build at home from plans in the *T-Hunt Book* and the *ARRL Handbook*. FAR Circuits sells a solder-up RF-tight enclosure for your home-brew attenuator to save you a session at the shear. Wired/tested attenuators are available from Arrow Antenna.

### Instant bearings from Dopplers

Yagis and quads are simple, inexpensive, and effective for two-meter mobile RDF, but they require the operator to turn carefully and interpret the S-meter readings. If the target signal is varying in power or pulsing on and off, it may be impossible to get an accurate bearing with a bouncing S-meter. On the other hand, Doppler sets do not use signal strength as a bearing criterion.

Dopplers have no moving parts—just an array of vertical whips (usually four) atop the vehicle. The display is a circular ring of light-emitting diodes (usually 16). Dopplers work in conjunction with your existing VHF-FM mobile transceiver, handie-talkie, or scanner, attaching to the antenna and external speaker/earphone connectors.

Switching diodes connect each whip to your receiver, one at a time in sequence. The receiver operates as if it were connected to a single antenna rotating around an invisible vertical axis in the center of the array. This pseudo-rotation causes FM modulation to appear, superimposed on the received FM signal as a tone at the rotation frequency. The phase of this demodulated tone, relative to the antenna switching sequence, determines the direction of the incoming signal.

From an ease-of-use standpoint, a Doppler is nearly ideal. One LED at a time comes on to indicate direction of the signal relative to the front of the vehicle. The top LED in the ring represents

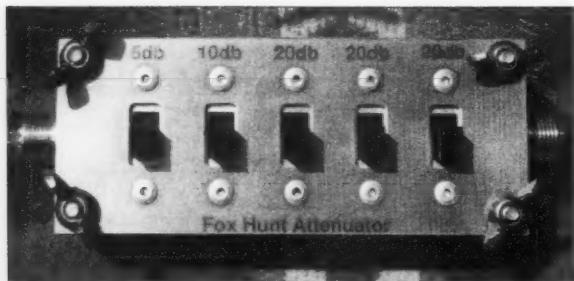


**Photo B.** Bandmaster quads for two meters are available with two, four or six elements. Note the SO-239 coax connector at the lower corner of the driven element.

signal dead ahead. Dopplers take bearings several hundred times per second, so they can capture a signal of very short duration and hold the bearing to it when the signal goes off.

Many hams have successfully built their own Dopplers. The most popular such project for home construction is the Roanoke Doppler, which you can duplicate for less than \$150. Complete plans for the display unit and a two-meter four-element antenna are in the *T-Hunt Book*. I recently designed an improved antenna system that is more sensitive, covers a wider frequency range and can be built either as a one-piece assembly or with four ordinary magnetic mount whips. See "Homing In" for April and June 1995 or the "Homing In" Web site for details of this antenna.

By building your own Doppler set, you will save money and learn about Doppler technology. For hams who aren't ready for that or who want more "bells and whistles," two commercial Doppler manufacturers have affordable products for the ham market. The 4000 and 5000 series models from Doppler Systems Incorporated feature a patented method of "soft-switching" the four whips to reduce cross-modulation effects. Prices start at \$620 for an LED display unit plus four magnetic-mount whips. Higher-priced models add voice readout, digital bearing output and other advanced features.



**Photo A.** You will need an RF attenuator for closing in on the transmitter with your beam or quad. This resistive unit was made by Arrow Antenna.

## NEVER SAY DIE

Continued from page 77

I was "downsized" when the TV station I was working for (KBTB in Dallas) shifted from live programming to all film, eliminating the need for a director for their live shows.

Okay, what's the first letter on the eye chart? That big one up on top? It's an E and for me it stands for entrepreneurialism. That's the subdivision of capitalism that works the best. And it's the key to your freedom from being hired or fired, from commuting, from being downsized, or replaced by a someone in Pakistan who's better educated than you and will work for 10% of what you've been pulling down.

If you're totally wasting an hour or two a day commuting to work, what do I have to do, come and shake you personally to get your attention? How can I get you to wake up and take charge of your life?

And the same thing goes for your health. You've heard the old saw about you being what you eat? Well, you know it's true, but as long as your body is able to survive the crap you've been eating, drinking and breathing, you make do with arthritis, an occasional heart attack, cancer, and other results of your gross neglect.

As far as your health goes, no, I'm not going to tell you what to do. But I am going to aim you at some books which I've found reliable which will let you educate yourself.

Those years you wasted in our public school system did *not* educate you. Wait'll you read some of the books on my list about that scam. It may almost make you mad.

Book list? It's a 28-page list of almost one hundred books I say you are crazy if you don't read. No, I don't sell the books—that would be a conflict of interest. The list includes a brief explanation of why each book will be valuable to you and how you'll benefit from reading it. I've reviewed many of the books in my editorials, but you've forgotten about 'em already. The list is a measly \$5 from Radio Bookshop.

Just the books on health that I review can change your life, adding at least an extra 20-30 years of robust health to it.

continued on page 84

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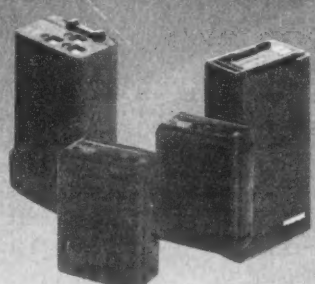
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PB-7SM	7.2v	2200ma	EBP-22SM	12v	1300ma	EBP-34	4.8v	1200ma
PB-8SM	12v	1300ma	EBP-24SM	7.2v	2200ma	EBP-34S	4.8v	1600ma
PB-17M	12v	1300ma	EBP-34M	4.8v	2200ma	EBP-35	7.2v	900ma
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CIRCLE 68 ON READER SERVICE CARD

The DFjr from Agrelo Engineering is a new entry into the Doppler market featuring digital processing of bearing data. At \$350, it includes the LED display and a set of four magnetic-mount whips on an aluminum crossbar frame.

Once the incoming signal is above the level necessary for a Doppler to acquire bearings, direction indications are independent of the signal strength. So how do you know for sure when you are close to the hidden T? When searching with a Doppler on my mobile transceiver, I remove the antenna from my handie-talkie, turn it on and place it on the dashboard. As the signal breaks squelch on the handie-talkie and becomes full-quieting, I am able to gauge my progress as I close in.

A Doppler is rapid-responding, convenient, and easy to mount on any vehicle, but it is not always the best tool for the job. In areas of high signal reflections, Doppler displays may dance wildly, making it difficult to discern a bearing trend. Because they do not use gain antennas, Dopplers are less sensitive than beams. Dopplers are seldom usable at the starting point of southern California's long-distance weak-signal hunts.

Sensitivity and accuracy of the Doppler method is degraded when the target signal is horizontally polarized. In that case, signal reflections are enhanced relative to the direct signal, making tracking much more difficult in urban or mountainous terrain.

The Doppler technique requires a receiver with FM detection, no matter what modulation is on the target signal. Doppler sets will not track non-carrier modes such as single sideband and pulsed noise. Bearings taken while the vehicle is in motion are usually more reliable than when stopped.

#### End of the road—time to sniff

Sometimes you can't drive all the way to the signal source. The spurious signal you're tracking may be inside a building. Which floor? What room? A hidden T may be in a field or a park, away from vehicle access. RDF on

foot when you have driven as close as you can is usually called "sniffing."

International-style radio-orienting contests are all sniffing, no vehicles at all. If you are tracking the beacon at the end of a high-altitude balloon flight, you may need to look miles away from the nearest road. Your mobile-mounted beam or Doppler isn't suited for these tasks.

A crude way to get bearings in the field is to use body shielding maneuvers with your handie-talkie. Directional antennas are far more effective, however. Usually you have plenty of signal when sniffing, so a small handheld beam of two or three elements is fine. The N6WZI yagi described in "Homing In" for May 1996 is a great do-it-yourself sniffing project. If you don't want to home-brew, consider the three-element yagi from Arrow Antenna or the two-element quad from AAE Bandmaster.

An ordinary resistive attenuator won't stop your hand-held receiver or scanner from being swamped by signals leaking through its case as you approach a hidden transmitter. To get bearings under these circumstances, consider an offset attenuator. The oscillator and mixer stages in this device shift the T's frequency by about a megahertz and control amplitude of the shifted signal. Just retune your receiver to the offset frequency and continue to take bearings. You can purchase an offset attenuator from Antennas West; just a home-brew version are in recent editions of the *ARRL Handbook*.

Another way to continue when the two-meter signal is too strong is to track its third harmonic with a dual-band handheld. Normally, harmonics are 40 to 60 dB weaker than the fundamental, so a beam for 440 MHz will get bearings on it to within a few feet. The Bandmaster Q-440-6 quad and the Arrow 440-5 yagi are small enough to tote along when you sniff. The Arrow 146/440-8 has separate elements and feedpoints for both two meters and 70 cm on the same boom.

I am nearly out of space for this month's column, but I'm not out of suggestions for VHF RDF

equipment. Come back next time to learn about "buzz boxes" and field-strength meters. You will also find out what TDOA stands for.

My "Homing In" site on the World Wide Web [<http://members.aol.com/homingin/>] has a wealth of information to help you and your club get started in the fun of hidden transmitter hunting. You will find hot links to sites of many RDF equipment suppliers mentioned in this article. There are several detailed technical articles, including modifications and improvements to popular RDF products. One page lists sources of components and assemblies for home construction of RDF gear, including four makers of circuit boards and kits for the Roanoke Doppler project.

Want to find out about T-hunting in your neighborhood? Check the links page for Web sites and E-mail addresses of RDFers in over 40 urban and rural areas of North America. All of them are eager to hear from "Homing In" readers who might join in their hunt activities. There are even RDF-related links to 15 other countries around the world, most of them in English.

Even if you don't have Web access, I can put you in touch with RDF enthusiasts near you. Send inquiries via E-mail to [[Homingin@aol.com](mailto:Homingin@aol.com)] or via postal mail to the address at the beginning of the column. If your club has T-hunts and isn't listed at my site, be sure to let me know about that, too.

#### RDF Antenna and Equipment Manufacturers

AAE Bandmaster Enterprises  
3164 Cahaba Heights Road  
Birmingham AL 35243  
(205) 970-0622

Agrelo Engineering  
P.O. Box 231  
Pattersonville NY 12137  
(518) 864-7551

Antennas West  
Box 50062  
Provo UT 84605  
(801) 373-8425

Arrow Antenna  
1803 S. Greeley Highway #B  
Cheyenne WY 82007  
(307) 638-2369

Cubex Quad Antennas  
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Brea CA 92821  
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Doppler Systems, Inc.  
P.O. Box 2780  
Carefree AZ 85377  
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12218 Greentree Road  
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(619) 748-0708



**Photo C.** The L-Per dual-antenna and receiver set by L-Tronics is designed for on-foot tracking of aircraft emergency beacons as well as hidden ham transmitters. Cathy Livoni KD6CYG is using this one at the Fullerton Airport.



## You Need This Book!

*Ferromagnetic-Core Design and Application Handbook* is new from MFJ Publishing. Written by the legendary designer Doug DeMaw W1FB, it's a quick, handy reference guide or good study manual for amateur operators, and it's only \$19.95. It's also the only book that emphasizes the practical aspect of magnetic core materials from low frequencies through UHF.

DeMaw gives you an in-depth understanding of theory and many practical circuit examples using toroids, rods and pot cores of ferrite and powdered iron. You also get lessons about proper core

selection versus operating frequency, circuit Q, power handling capability, and physical mass. Equations are used only when needed to illustrate a concept or design example—tedious mathematics have been omitted to make the *Handbook* easier to understand.

Order toll-free by calling (800) 647-1800; for more information or your nearest dealer, contact MFJ Enterprises, Inc., 300 Industrial Park Road, Mississippi State MS 39762. Telephone (601) 323-5869; FAX (601) 323-6551; or check out the Web site [<http://mfjenterprises.com>].

## Happy 40th!

The Cubex Antenna Company proudly announces its new line of 40-meter antennas—the "Mantis." The Cubex 40th anniversary antenna, it's available in 2 and 3 elements, and up to 7 bands. Prices range from \$1,199.95 for a 2-element 40-meter antenna on a 15 x 3 boom to \$2,379.95 for a 7-band antenna featuring 4 elements on 10-12-15-17 and 20 meters and 3 elements on 30 and 40 meters. Contact Cubex for details: 2761 Saturn Street, Unit C., Brea CA 92821. Telephone (714) 577-9009 or FAX (714) 577-9124.

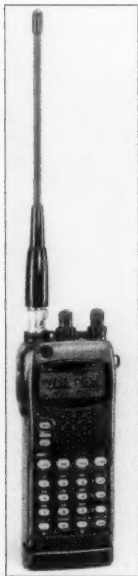
## User-Friendly Handhelds

ICOM Inc. brings you the IC-W32A (US version) and the IC-W32E (Europe version) handheld high performance dual-banders to meet the demands of both the novice and the experienced operator: simple operation and advanced features.

The W32 series has separate tuning and volume controls for each band on the top panel, allowing independent adjustment of either band. A new function, the VHF/UHF exchange, allows you to assign VHF/UHF tuning and volume to either knob—set your preferred band to the knob that gives you easiest access.

Independent main and subbands let you receive both VHF and UHF simultaneously, or use the V/V or U/U functions for receiving two frequencies on the same band. There are 200 memory channels; assign a name of up to eight characters from the keypad, and, through the use of an optional cloning cable, transfer stored information from one IC-W32A/E to another. There's a ton more

stuff you'll want to find out about, so contact your ICOM dealer or ICOM America, Inc., 2380-116th Avenue N.E., Bellevue WA 98004; phone (206) 454-8155.



## More Power

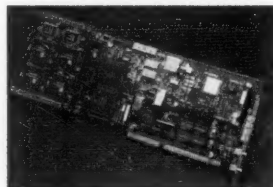


The new Powerport 149 from Cutting Edge Enterprises may be just what you've been looking for, if you need to run/charge radios, soldering irons, test equipment, emergency lights, laptop computers, video cameras, hand-held GPS receivers, FAX machines, electric hand tools—pretty much anything that requires power.

The Powerport 149 weighs nine pounds, measures 4" x 4.5" x 6", and provides 140 watts of 115V AC (surges to 200W), and up to 20 amps of 12-volt DC power. It will keep a portable fluorescent light going for more than 24 hours, or a hand-held radio running for 80 hours. Can you think of an emergency situation that *couldn't* use one of these babies?

Powerport can be charged in your vehicle through the cigarette lighter without the engine running, or it can be left plugged into a wall outlet without fear of overcharging. Flexible solar panels are an option, as is the padded carrying case, with detachable accessory pouches.

For further information contact Roger Hall at Cutting Edge Enterprises, 1803 Mission St., Suite 546, Santa Cruz CA 95060; phone (800) 206-0115.



## ST-108 Spread Spectrum Matched Filter Demod

SIGTEK, Inc., announces the release of the ST-108 Spread Spectrum Matched Filter Demodulator for cellular CDMA, satellite, and point-to-point microwave applications. The board supports direct sequence chip rates up to 30 MHz and data rates in excess of 2 Mb/s/sec. The PC/AT compatible ST-108 is available with either a 70- or 140-MHz IF. Programmable digital filters shape and filter the input signal for optimum performance. A programmable 1024 digital matched filter provides instant signal acquisition. An optional

daughter board adds powerful concatenated Convolutional/Reed Solomon Forward Error Correction.

The ST-108 is controlled through a sophisticated Windows 95™ interface that allows rapid setup of all key parameters such as input filtering, chip rate, spreading code, and data format. A DLL is also available for standalone applications. For more details, contact SIGTEK, Inc., at 9841 Broken Land Parkway, Suite 206, Columbia MD 21046. Phone (410) 290-3918 or FAX (410) 290-8146.

**Manufacturers: your product releases could be here. Contact Priscilla Gauvin at: 73 Magazine 70 Rt. 202N Peterborough NH 03458.**

There's an awful lot of baloney out there in the alternative health field, so you need someone to sort things out for you.

Now, getting back to the big E. If you've forgotten the things I've written about that down through the years, you'll do well to invest \$5 in my *Making Money, A Beginner's Guide*. Every now and then I get a phone call or letter from a graduate of Green's School of Entrepreneurialism thanking me for changing their lives. I want to get you to consider the freedom I offer and go for it so I'll get that letter from you in a couple of years.

The strength of our country lies in small businesses, not in giant industries. As far as I know, every big business is crooked and aiming to get bigger and bigger. When they get really big they become international and their interests aren't the same as ours. But with their money they have the power to pretty much control our country via hordes of lobbyists in Washington and every state capital.

So stop wasting your life working for someone else and start thinking about having your own business.

Darn, they're making soap boxes out of cardboard these days and they keep breaking.

### Cancer!

A hundred years ago cancer was almost unknown. Today it will affect the lives of at least 50% of you. It's more like 100%, if you count your family. So what's gone wrong to bring on this epidemic, and how come the medical industry has been almost powerless to do anything about it?

As you read the books I've recommended on health you'll find that our medical industry is centered on treating symptoms, not getting at causes so that illness can be prevented. So what's causing this cancer plague? And what can you do to avoid being another victim? The major problem seems to be a weakening of our immune systems, caused by an increase in our poisoning ourselves. Poisoning? You bet! We're doing a real job on ourselves with stuff like aspartame (a.k.a. Nutrasweet™—the blue

stuff), fluorides in our drinking water, chlorine ditto, dioxin ditto, dental amalgam (mercury poisoning), air pollution (how well are you filtering the air in your home and office?), keeping needed UVs out of our eyeballs, eating crap like sugar and white flour products, burgers and fries, meat laced with growth hormones, fruits and vegetables grown in almost totally mineral-depleted land. We're giving our bodies a fraction of the water it needs to flush out toxins. And have you read the list of chemicals they're putting into our foods to keep it from spoiling on grocery shelves? Do you really think that stuff won't collect and screw up your body? And I'm not even going to bother mentioning the effects of alcohol, cigarettes, and caffeine. Oops, I almost forgot root canals and EMFs.

Over a million years or so our bodies developed to work best on the nutrients then available. Now we've changed all that and we wonder why we're doddering into nursing homes in our 60s instead of raising hell?

So we poison our bodies into sickness and then we go to the doctor and get an expensive medication. Another poison. The \$1.5 trillion medical industry is controlled almost totally by a few major pharmaceutical companies. Their worst nightmare is an inexpensive cure for an expensive illness. And remember, nobody in the industry makes any money until you get sick. That's when you'll spend whatever they demand to get well. And this is happily supported by the insurance industry (you've seen their huge modern buildings, right?), which also has a large negative interest in your being healthy. When you get sick they pay, and that's known as cash flow. Then they charge higher premiums. They get their cut, so the more they have to pay out, the more profit they make.

Start reading the books on health on my list. The Comby book on a raw food diet. The Batmanghelidj book on water. The Wallach book on playing doctor. The Coca book on allergies. The Lane book on shark cartilage, which looks like one of the best answers to the cancer problem, once you've poisoned your body to that extent. Cayenne to avoid heart attacks.

The Bioelectrifier looks like it can help rebuild immune systems, and colloidal silver

holds some great promises. I'll try to keep you up to speed in these fields as I learn more.

But if you keep putting sand and sugar in your gas tank, your engine isn't going to last long and you'll be doddering with your walker to hamfests. Or zipping around in one of those handicapped mobiles. So go ahead, hoist a few more beers and buy another carton of cigarettes.

I eat mostly vegetables and fruit these days. I'd eat more meat if I knew where to buy meat safe enough to eat raw. I love raw meat and raw fish. Sashimi. In Tokyo I was treated to a chicken dinner that started out with chicken sashimi and it was delicious. But the chicken we get from the supermarket is so laced with salmonella and other microbes that it's as dangerous as eating blowfish. Hey, I've got to find out more, but I'll bet a good dousing in silver colloids might make fish and meat safe to eat raw. Do you know anything about that? It seems reasonable, but I'm not yet ready to bet my life on it.

Yes, I've eaten blowfish. And survived. I recently saw the episode of "The Simpsons" again where Homer ate some and was told he was going to die in 24 hours.

Speaking (well, writing) of medical alternatives, if you think I'm alone in putting down the medical industry, do some alternative cruising of the Internet. Check out the Royal Rife Web page and see what that bunch has to say about the medics and their support by the feds, which is an incestuous relationship.

One of the books on my list is about Dr. Naessens, who, like Rife, but more recently, invented a super-powerful microscope. And he, like Rife, was thus able to see an even more basic form of life than the cell, one which seems almost indestructible. He called it a somatid. And he, like Rife, was persecuted by the medical establishment, complete with swat teams raiding his laboratory and destroying his notes and equipment. Well, he, like Rife, did a terrible thing; he found an inexpensive cure for cancer and used it to cure a bunch of people.

### Screw the Generals

No, good heavens, not General Class operators—I'm referring to such generals as General Motors, General Foods, General

Mills, General Instrument, and General Dynamics—the gigabuck conglomerates. Capitalism works first rate when it comes to smaller businesses, but it goes awry when corporations get big enough to dominate an industry.

I keep a copy of Ted Quinn's 1953 book, *Giant Business, Threat To Democracy*, at hand. Ted had been an insider, the vice president of GE, and saw what was going on when corporations get too big. Not only can they squash or limit their competition, they also have lobbyists in Washington to make sure that they have the government behind them in doing it. Larger corporations have lobbyists in every state capital too. I was amazed when I looked over a list of the registered lobbyists in Concord, my state capital.

The real strength of any country lies in the proliferation of small businesses, not in growing giants, which tend to be international entities, with it being irrelevant where the owner is.

For a while our government tended to keep a loose lid on big-business with their anti-monopoly suits, but how long has it been since you've read about one of those? They did break up AT&T and slowed IBM down for a few years, but these days we're seeing the big get bigger by gobbling up the other big guys as well as bundles of smaller businesses.

I don't have any proposed solutions for this weakness in capitalism, I just wanted to make sure that I have company in worrying about it. Since the giants are essentially running the government, we can't really expect much help from that quarter. And, until we're able to improve our school system, we're not going to have many people with the guts to cooperate to do something from the grass roots.

A recent letter from a reader mentioned that a psychology professor opined that our school system destroys initiative in all but about 5% of the people. That helps explain why I'm up here on my soap box waving my arms in dismay to so few people. Everyone else is hypnotized somewhere watching a ball game. Or at a church supper.

### Shortchanged

I've been shortchanged. You've been shortchanged. We've been

lied to, hypnotized, and brainwashed by the media, the school system, and the government... with the result that around 99% of us are taking all the crap that's going on and believing that there isn't anything we can do that will make a difference. Imagine what a country this would be if 250 million people decided to make a difference! Heck, if just a few thousand decided that they were going to actually do something about the mess.

We're taught in school that honesty pays. Well, that's hokey! Another con job. Honesty doesn't pay worth beans. I've had bigger screw jobs than anything you can imagine, and not one was done honestly. Hey, I had a \$100 million property stolen and there wasn't one damned thing I could do about it.

Every industry that I've gotten into has turned out to be crooked to the core. I've written about the magazine distribution industry and its crime connections. And about the music industry, also with organized crime connections. Not one industry that I've gotten to know about intimately has turned out to be honest.

Our country is run by crooks. I'm exaggerating? Then you haven't done your homework and read the books on my list of 98 *Books You're Crazy if You Don't Read*. I'll bet you haven't even read P.J. O'Rourke's *Parliament of Whores*. If the government was honest there wouldn't be thousands of lobbyists being paid billions of dollars every year to bribe government officials.

You? Hypnotized? Brainwashed? Sure, get angry with me for bringing it up. But, just for a minute, remember the denial alcoholics and other drug abusers are into. Remember that when someone is given post-hypnotic suggestions (orders) they will faithfully carry them out, rationalizing their every action.

If you are commuting to work... if you are worried about being downsized, outsourced, laid off, fired, then you're in need of a deprogramming intervention. If you don't love what you're doing you've been brainwashed into accepting a sort of slavery. Slavery to big government and big business.

Does it bother you that the first five months of the year you are working for the government? Or is it six now? So what are you

getting in return for all that time and work? Hmm, let's see. We get roads to drive our cars on. Of course, unless we pay a stiff tax on our car every year, we can't use it. And the gas we use is taxed too. Indeed, that alone is supposed to be paying for the roads. But that's a state matter, not federal. What is the federal government doing for us?

Well, there's the military. Yep, we gotta have one of those. Well, there goes 5% of the federal budget. We get the services of the FAA, which makes flying safer. Okay. And we get the FCC, which regulates the airwaves. There's some good in that too. And there are our national forests and parks.

Well, how about social security? As Steve Forbes has pointed out, if the feds would let us put aside the same money in private accounts we'd get back almost four times as much as we do now. Well, it costs a lot to support millions of government employees and their generous pension funds. Social security is one hellacious screw job. It's just another tax where they, in essence, take around \$4,000 from a senior every month and give him \$1,200 back. Here, let's see you live on that, old-timer.

If you weren't totally brainwashed you'd never in this world send your kids to a public school. And you'd be pretty angry over the poisoned garbage being sold by our supermarkets. I'm exaggerating? I wish I were, but then I haven't been able to get you to do your homework and learn what's actually going on. I'm not asking anyone to believe me, but I am asking that you check out the books I've found that make a lot of sense to me and which will give you a new perspective on things.

So you go along doing things you know you shouldn't and not doing things you know you should, and then when you finally break down your body you go to a doctor. Hmm, headaches, eh? Here's some pain killer. Cancer? Lordy, we've got to pour some industrial-strength poisons into your body and kill that damned cancer. If you ever find a doctor who tries to find out why you have the cancer, please let me know. I don't expect any mail to result from that request.

When you get sick it's because you've done it to yourself. The element of chance is what organ or part of your body is

going to crap out first. But you go merrily on, knowing or not knowing how you're lousing up your body. Your "education" did not teach you much about body maintenance, and even less about continuing to learn all through life. So you suck in on a life of Cheers bars, bowling, or watching ball games. Or sitcoms. And commuting to work until a computer or a Pakistani replaces you.

### Wayne Disappears!

A call from René, who wrote the book *NASA Mooned America*, which he's self published, reminded me that Bill Kaysing, who wrote *We Never Went To The Moon—America's \$30 Billion Dollar Swindle*, is suing one of the astronauts who called him "crazy" for libel. The case comes up in October, so Bill and René are busy organizing exhibits which will back up their contention that all the moon landings were faked.

I get kooky books sent to me all the time, so when René sent me a copy of his book I sighed and expected to read the usual polemic. Well, I've written about my conversion. Since then I've helped René sell hundreds of his books and not one person who's read his NASA book has written to say he thinks René has his facts wrong.

Kaysing, who worked for Rocketdyne during the years when they were developing the engines for the Apollo program, knew that the engines powerful enough for the moon shots had all failed and that the engines they ended up using couldn't possibly provide enough power for the trip. Knowing that the moon shots were impossible, Bill started researching the project, looking for other deceptions... and he found plenty.

Kaysing's book makes some of the same points as René's, but he also has a bunch more. Like the pilot of a commercial airliner flying to Tokyo who reported seeing a high-flying plane drop a command module, which then chuted to the ocean below. Or the recording NASA released of Armstrong and Aldrin talking with Mission Control while descending to the moon. The problem here is simple; a rocket engine developing 10,000 pounds of thrust generates about 140 dB of sound, so voices anywhere near it couldn't possibly be heard. And so on, for a long list of contradictions.

Now, will NASA and the CIA, who apparently worked with NASA to put over this charade, let this come to trial or will Kaysing and René both disappear or inexplicably die... as have several other whistle-blowers? Will they be after me too? I've already had one government agent tell me flat out that if I ever wrote about his agency again he guaranteed I would be put in prison and never get out. No, I haven't written about them again.

The government we have today bears little resemblance to that envisioned by our founding fathers. No, it's not as bad as Russia or China, but we sure could use some housecleaning. And the Senate too.

How could NASA and the CIA pull off a \$40 billion swindle like that? Well, you saw the *Apollo 13* movie, right? That was a movie. And maybe you saw *Capricorn One*? Well, rent it, then.

When Kennedy said we'd go to the moon and Congress budgeted for it, NASA was faced with a serious problem when they later discovered that they weren't going to be able to do it. Should they give up years of nice-paying jobs or fake it? Not many people had to know the truth, so there was a good chance of maintaining secrecy.

Since I originally wrote about René's book I've heard from several people who were not at all surprised as a result of their own work on NASA and related projects.

Well, I hope they won't feel it necessary to terminate me—I just have so much more to write and do before termination. And I'm anxious to be around to see if the prophecies for world cataclysm in 2000 and 2012 pan out. Golly, I'd sure hate to miss out on a cataclysm.

### The Magic Bullet

While we're healthy we don't give much thought to preventing illness. When we get sick we look for a fast remedy—at least something to get rid of those darned symptoms. The body has an excellent repair system built in, but it can be disabled, allowing all sorts of opportunistic invaders to take hold.

The Bioelectrifier looks like a good approach to helping the body get rid of invaders such as microbes, parasites, yeast infections, viruses, fungi, and so on.

*Continued on page 88*



Michael Bryce WB8VGE  
P.O. Box 508  
Massillon OH 44648

Last month, I mentioned I would be presenting a different project. However, this is a project you should not necessarily run out and build. It's more of an experimental project, although it does serve a real purpose in life.

## The project

As odd as it sounds, the project is a ten-minute ID timer. As I said, nothing special. Oh, no? What makes this timer different is how it works. But first, some background on the ID timer.

## Another project—another circuit

I had been working on a different project and needed a way to produce a pulse every ten minutes or so, and at the end of the pulse, the output had to stay on for a second or two as well.

Normally, when someone needs a circuit for a simple timer such as I described above, an LM555 timer is used. However, in this case, I also needed a two-second pulse at the end of the time period. With two separate time periods, that would require two LM555 timers, or one dual timer, the LM566.

This was not acceptable. I needed a very small parts count for the circuit I was developing, and adding one more chip was not an option. In fact, I did not want to add a single chip to the project. I had one section of an op amp left with

## Low Power Operation

which to build a long-duration timer and produce a two-second pulse.

I also required the circuit to reset and start timing again once the long-duration time period was up, so what you see in **Fig. 1** is the result of many hours of daydreaming and lots of paper!

## How it works

My one section of an LM358 op amp is the heart of the timer. For clarity, I show this one section only. The other section is used by the rest of the circuit and is not required by the ID timer.

## Generate the ten minutes

The Vcc in this ID timer is +8 volts. I used a small 78L08 regulator. It's part of the overall circuit and not shown in this schematic. Vcc is applied to R7 and slowly charges C1. Capacitor C1 is a husky 4700  $\mu$ F electrolytic capacitor. The time it takes to charge is determined by the Vcc and R7. For this reason, we use the eight-volt regulator to ensure a constant timing period.

The positive input of the LM358 monitors the charge on C1. The negative input of the LM358 compares the charge on C1 to the reference generated by R16 and R17. In effect, they divide the Vcc by half. Again, another reason for the regulated Vcc required for the ID timer.

With the values shown for R7, it takes about 9 minutes for the charge on C1 to match the reference on pin two of the op amp. The R/C time

constant makes up the long-term time period of the timer.

When the comparator switches states—it is normally off or low—several things happen.

First, the long-duration timer must be reset. This is accomplished by turning on Q2 via R18.

Now we must also generate the two-second pulse at the same time. To accomplish this feat, I added some rather heavy hysteresis to the op amp. This hysteresis loop consists of R10, D4 and R8. When the op amp switches, this hysteresis loop will offset the voltage of the R7/C1 sample, effectively holding the output of the op amp on slightly longer. However this is still not enough to produce the two-second pulse.

I had to add R9 to slowly discharge C1. The trick was to find a value of R9 to produce the required two seconds while discharging C1 down enough to generate another ten minutes' worth of charging. If you increase the value of R9, you get a longer pulse at the end, but you shorten up the time it takes to recharge C1. Make R9 smaller, and you get a shorter pulse and longer recharge time on C1. With the values I have shown in the schematic, you'll get a two-second pulse about every 9.3 minutes.

You can also change C1. Adding more capacitance will of course make the timer run longer. A smaller value for C1 will reduce the timing cycle. If you don't have one large cap, feel free to use several in parallel.

The output from the op amp can be used to drive an LED or tone generator. I use a solid-state sounder I picked up from a hamfest. Its low current allows it to be driven directly from the LM358's output. If you require higher output switching, you can use a transistor switch as shown in the schematic. Basically, it's just a cheap NPN transistor that's turned on by the output of the LM358. If you decide to use a relay as the high current switch, be sure to add a small diode across the coil's terminal

to prevent the EMP pulse from zapping the switching transistor.

## Building the IDer

I have no PC board for this project. I figured it would take about as much time to lay out a PC board as to use point-to-point construction. Perfboard would be the first choice for me. I used a prototype solderless setup to test the circuit. If you don't have one of these, I suggest you invest in one.

Keep the Vcc steady; aside from that, you can use +12, +8, or +5 volts for the Vcc. If you change the Vcc from the +8 volts I used, you may have to fudge either or both R7 and R9. There is no need to change out R16 or R17. They will divide the Vcc in half regardless of the Vcc used.

You can save some money by getting C1 with a 16 VDC rating. The Digi-Key price for the cap is about \$4 each. I've seen caps that will work from Hosfelt for a quarter a pop!

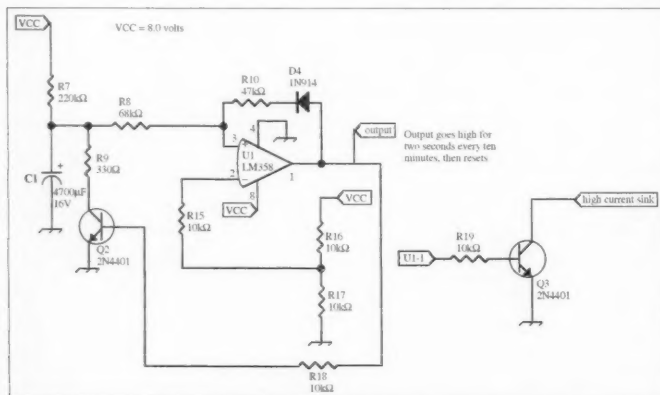
The entire idea of the ID timer is to use a leftover op amp in one of your projects. You may have one section left over from an audio filter in a direct conversion rig. Here is your chance to wire up an ID timer without adding an extra chip.

## Playtime

For goodness' sake, please play with this circuit. It's meant to be changed. Use the basic circuit to start with and change values as you go. If you have a leftover op amp in one of your rigs, go ahead and build in an ID timer!

## QRP kits from Ten-Tec

Here's some info on the newest QRP kits from Ten-Tec: The new rigs are designed for 80, 40, 30 and 20 meters. Easy to build and simple to operate, each unit covers a 50-kHz segment selected at time of construction. Kit includes all required components and professional enclosure painted and fully silk-screened. Receiver performance is superlative and QSK is just what you expect from the hams at Ten-Tec. I'll have a complete review of this new QRP transceiver from Ten-Tec. Look for it soon. Next month, I'll have some ideas for running our low power rigs on batteries in the field, and other interesting stuff.



**Fig. 1.** The low-tech 10-minute timer, shown with the high-current driver option.

# PROPAGATION

Jim Gray W1XU  
210 Chateau Circle  
Payson AZ 85541

May is expected to be a rather bland month for DX propagation because of the approaching summer solstice, although there may be some days of high sporadic E propagation. Look for prime conditions (G) between 1-4, 9-17, and the 31st. Look for only fair (F) conditions 6-7, 19-21, 25, and 29th. The remainder will be trending. I don't foresee any major ionospheric

or magnetic field upsets or any major geophysical problems this month. At the time of preparing this forecast (February), the solar flux remains at a disappointing low value of between 70 and 75, with no apparent upswing yet in sight. Sunspot numbers continue low, and the sun is very quiet. Considering this prolonged minimum, I suspect cycle 23 will be off to a slow start and a low peak of 150-200 flux units sometime around the

## EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA							20	20				
ARGENTINA								15	15	15	15	15
AUSTRALIA						40	20	20			15	15
CANAL ZONE	20	40	40	40	40		20	15	15	15	15	20
ENGLAND	40	40	40				20	20	20	20		
HAWAII		20			40	40	20	20				15
INDIA							20	20				
JAPAN							20	20				
MEXICO		40	40	40	40		20	15	15	15	15	
PHILIPPINES							20	20				
PUERTO RICO		40	40	40			20	15	15	15	15	
RUSSIA (C.I.S.)							20	20				
SOUTH AFRICA										15	15	15
WEST COAST			80	80	40	40	40	20	20	20		

## CENTRAL UNITED STATES TO:

ALASKA	20	20						15				
ARGENTINA										15	15	15
AUSTRALIA	15	20				40	20	20				15
CANAL ZONE	20	20	40	40	40	40			15	15	15	20
ENGLAND		40	40					20	20	20	20	
HAWAII	15	20	20	20	40	40	40					15
INDIA								20	20			
JAPAN								20	20			
MEXICO	20	20	40	40	40	40			15	15	15	20
PHILIPPINES								20	20			
PUERTO RICO	20	20	40	40	40	40			15	15	15	20
RUSSIA (C.I.S.)								20	20			
SOUTH AFRICA										15	15	20

## WESTERN UNITED STATES TO:

ALASKA	20	20	20		40	40	40	40				15
ARGENTINA	15	20		40	40							15
AUSTRALIA		15	20	20			40	40				
CANAL ZONE			20	20	20	20	20	20				15
ENGLAND									20	20		
HAWAII	15	20	20	40	40	40	40					15
INDIA			20	20								
JAPAN	20	20	20			40	40	40			20	20
MEXICO			20	20	20	20	20					15
PHILIPPINES	15						40		20			
PUERTO RICO			20	20	20	20	20	20				15
RUSSIA (C.I.S.)									20			
SOUTH AFRICA										15	15	
EAST COAST		80	80	40	40	40	40	20	20	20		

## MAY 1997

SUN	MON	TUE	WED	THU	FRI	SAT
				1 G	2 G	3 G
4 G	5 G-F	6 F	7 F	8 F-G	9 G	10 G
11 G	12 G	13 G	14 G	15 G	16 G	17 G
18 G-F	19 F	20 F	21 F	22 F-P	23 P	24 P-F
25 F	26 F-P	27 P	28 P-F	29 F	30 F-G	31 G

year 2003. Most observers consider an average solar cycle to be around 11.2 years, but there seems to be mounting evidence that the *true* cycle is closer to 23 years on average—with two peaks and three minima—similar to a sine wave, if you want to visualize it. I fervently hope this rather gloomy forecast is wrong, but we'll have to wait and see, won't we?

### 10-12 meters

You may expect occasional short-skip openings from about 500 to 1500 miles. There may be rare openings to greater distances, but not regularly.

### 15-17 meters

You can expect some reasonable short-skip propagation out to 1500 miles or so, and occasionally greater distances, particularly transequatorial DX skip—with sometimes surprising signal strengths.

### 20-30 meters

As almost always, 20 meters will be your best DX band for both daytime and evening periods. Twenty will stay open until well after dark, and thirty really begins to shine in the late evening hours. Peak conditions exist shortly after sunrise at your location, and again in the late afternoon. Midday conditions are not likely to be good due to excessive ionization and absorption. Short skip will be excellent out to about 2500 miles on both bands on the best days.

### 40-80 meters

Forty will be excellent after dark unless the noise levels from thunderstorm activity are excessive. These will be "all-night" bands, with 40 slightly better than 30, except for noise. Daytime short skip will average 1000 miles or more and nighttime short skip will average 1500 miles or more—usually more.

### 80-160 meters

These two bands are not known for summertime DX, and May is close enough to summer to be a problem because of high noise (QRN) levels. However, on quiet evenings you may find superb DX across the Atlantic on 80 meters for US and European hams. One-sixty is always a summertime problem, but those of you with Beverage antennas for receiving and vertical antennas for transmitting will do better than average.

### Gray-line DX

Always be aware that a half hour before and after local sunset often provides some really fine DX along the paths of darkness on all bands. Use it to your advantage. W1XU.

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## NEVER SAY DIE

Continued from page 65

But these beasts wouldn't likely have established a beach-head if the immune system was working well, so getting rid of them is only going to be temporary unless you make some changes.

The Bioelectrifier, or Beck Blood Purifier, was originally developed as a way to fight the AIDS scourge. But the alternative health care field is no more honest than our medical-pharmaceutical-insurance-FDA-NIH-etc. monopoly, so who knows what to believe? There are crooks and hucksters at every turn. The medical (etc.) industry has the government behind it because that's where the big money is. The doctors' organizations, nurses, hospitals, drug and insurance companies (etc.) all have well-heeled lobbyists with bribe money to invest in our politicians to make sure their companies prevail.

Now that there's no question but that vitamins help keep us healthy, the doctors via their lobbyists and their kept politicians are pushing the FDA to make sure that doctors get a piece of the vitamin action by making them available by prescription only.

Now, getting back to staying healthy. There are two major factors which combine to make us sick. One is the lousy treatment we give our bodies and the

other is stress—the psychological factors. A long time ago I reviewed a book, *Who Gets Sick*, by Dr. Blair Justice. I'll have to add that to my list of books you're crazy if you don't read. Blair makes an airtight case for the triggering effect of psychological problems. Almost 50 years ago, when Hubbard proposed this concept in his book, *Dianetics*, it was ridiculed by the medical establishment. Germs make people sick, not bad thoughts. Doctors have gradually come to accept the idea, but (as I've mentioned a few dozen times) none of them that I've ever heard of is doing one darned thing about it. They're busy treating symptoms with chemicals and knives, and to hell with the actual causes of the illnesses.

You gotta have both germs and bad thoughts. And a weak immune system.

So, sure, the Bioelectrifier may be able to work some temporary miracles, but in the long term you'd better start cleaning up your act, with both good nutrients and good thoughts.

A reader, whose father managed to blind himself by staring into the sun, was aghast over my mentioning the importance of getting UVs into your eyeballs. Hey, I keep asking you to get my review of the books you really need to read, and one of them, by Dr. William Douglass, explains in detail about UV-ing your eyes and the sicknesses that

ensue when you don't. Which most of us don't. We keep windows in our homes and cars between the sun and our eyes. And then, when we go out, we wear sunglasses. I haven't worn sunglasses since reading the book. Read the book! And no, I'm not recommending anyone stare directly into the sun. But you can cast your eyes into the sky near the sun so it can get into them

without frying them. It only takes a few minutes a day.

Read the books on water, our missing minerals, on a raw food diet, and so on. Either educate yourself and start avoiding things which will make you sick (no matter how good they taste), or suffer the consequences, turning to your doctor to try and effect repairs. Whoo, is that an expensive and painful way to go!

73

## UPDATES

Number 88 on your Feedback card

### Beam-aimer project.

In the February 1997 issue, **Fig. 4** on page 18 and **Fig. 6** on page 20 were wrong. If you are interested in Mr. Garrison's beam-aimer project contact us. We will be happy to supply you with full-size layouts of the copper sides of both boards. Please send a 6" x 9" SASE.

### Rusty Auxier KG4AU address correction.

In the February 1997 issue, Rusty Auxier KG4AU, president of the Guantanamo Bay ARC, appeared in our Ham Help section. His E-mail address was incorrect. It SHOULD HAVE BEEN [rustman1@aol.com].

73

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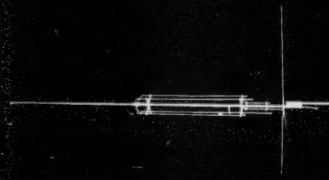
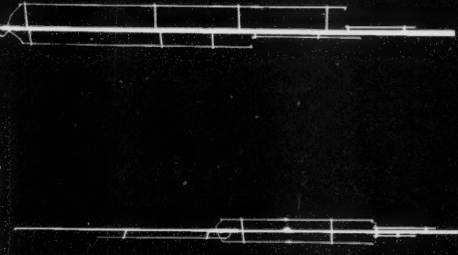


I FOUND A BOOK ON HOW TO INCREASE YOUR HANDHELD RANGE--- I BOUGHT A DOZEN COPIES, BUT MY RANGE IS ABOUT THE SAME



# GAP: THE PERFECT ANTENNA

We at GAP realize there isn't a perfect antenna. No singular antenna will scream DX on 80 and be the best for local nets on 10. If anyone tells you there is, beware! The perfect antenna does not exist, but the right one for you may. If you want something to bust the pile on the low bands, then consider the Voyager. Just starting out in ham radio and need a great general coverage antenna, the Challenger is easy to assemble and for little effort will yield superior performance, especially on DX. Maybe you knowingly or unknowingly moved into one of those "restricted areas" where the Eagle's limited visibility, but unlimited ability is desired.



Eagle DX

Challenger DX

Voyager DX

This chart helps you select the right GAP antenna. When comparing GAPs, bandwidth is not a concern. With few exceptions, a GAP yields continuous coverage under 2:1 for the ENTIRE BAND.

All antennas utilize a GAP elevated asymmetric feed. A major benefit is the virtual elimination of the earth loss, so more RF radiates into the air instead of the ground. This feed is why a GAP requires **NO RADIALS**. Just as elevating a GAP offers no significant improvement to its performance, adding radials won't either, making set up a breeze.

A GAP antenna has no traps, coils or transformers. This is important. The greatest sources of failure in multiband antennas are these devices. Perhaps you heard someone discuss a trap that had melted, arced or became full of water. Improvements to these inherent problems are the focus of the antenna manufacturer, while the basic design of the antenna remains unchanged. **GAP improved the trap by eliminating it!** Removing these devices means they don't have to be tuned and, more importantly, won't be detuned by the first ice or rain. The absence of these devices improves antenna reliability, stability and increases bandwidth.

Another major advantage to a GAP antenna is its NO tune feature. Screws are simply inserted into predrilled holes with a supplied nutdriver.

The secret is out and people in the know say:

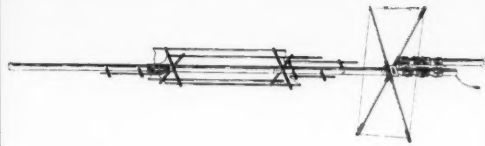
**CO**—The GAP consistently outperformed base-fed antennas...and was quieter."

**73**—This is a real DX antenna, much quieter than other verticals."

**RF**—To say this antenna is effective would be a real understatement. Switching back and forth on 40m between another multiband HF vertical and the GAP there was no comparison. Signals were always stronger on the GAP sometimes by 5 units, not just DBs."

**Worldradio**—These guys have solved the problem associated with verticals. That is, an awful lot of RF is wallowing around and dropping into the dirt instead of going outward bound. A half-wave vertical does need radials if it is end fed (at the bottom). But the same half-wave vertical does not (as much, hardly at all) if it is fed in the center."

**IEEE**—Near field and power density analyses show another advantage of this antenna (asymmetric vertical dipole): it decreases the power density close to the ground, and so avoids power dissipation in the soil below it. The input impedance is very stable and almost independent of ground conductivity. This antenna can operate with high radiation efficiency in the MF AM standard broadcast band, without the classical buried ground plane, so as to yield easier installation and maintenance."



This all purpose antenna is designed to operate 10m-80m, WARC bands included. It sits on a 1-1/4" pipe and can be mounted close to the ground or up on a roof. Its bandwidth and no tune feature make it an ideal antenna for the limited space environment as well as a terrific addition to the antenna farm.

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Eagle DX			■	■	■	■	■	■	■	■		19 lbs	1-1/4" pipe	80" Rigid	\$269
Titan DX			■	■	■	■	■	■	■	■		25 lbs	1-1/4" pipe	80" Rigid	\$299
Voyager DX							■	■	■	■	■	39 lbs	Hinged Base	3 Wires @ 57'	\$399



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